

DISCOVERY

A ~~MONTHLY~~^{LIBRARY} POPULAR JOURNAL OF KNOWLEDGE

JUN 5 1922

~~UNIV. OF MICHIGAN~~

EDITED BY EDWARD LIVEING, B.A.

SCIENTIFIC ADVISER: A. S. RUSSELL, D.Sc.

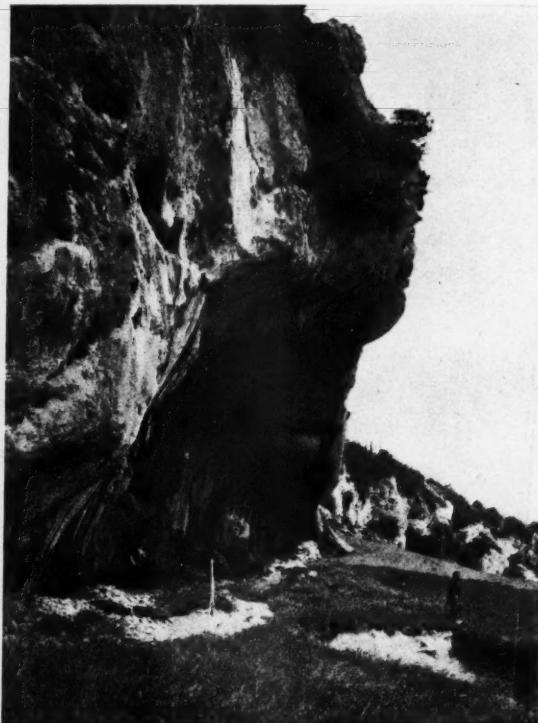
Trustees:—SIR J. J. THOMSON, O.M., F.R.S.
PROF. A. C. SEWARD, Sc.D., F.R.S.

SIR F. G. KENYON, K.C.B., F.B.A.
PROF. R. S. CONWAY, Litt.D., F.B.A.

Vol. III, No. 30. JUNE 1922

(Annual Subscription 12s. 6d. Post Free)

PRICE 1s. NET



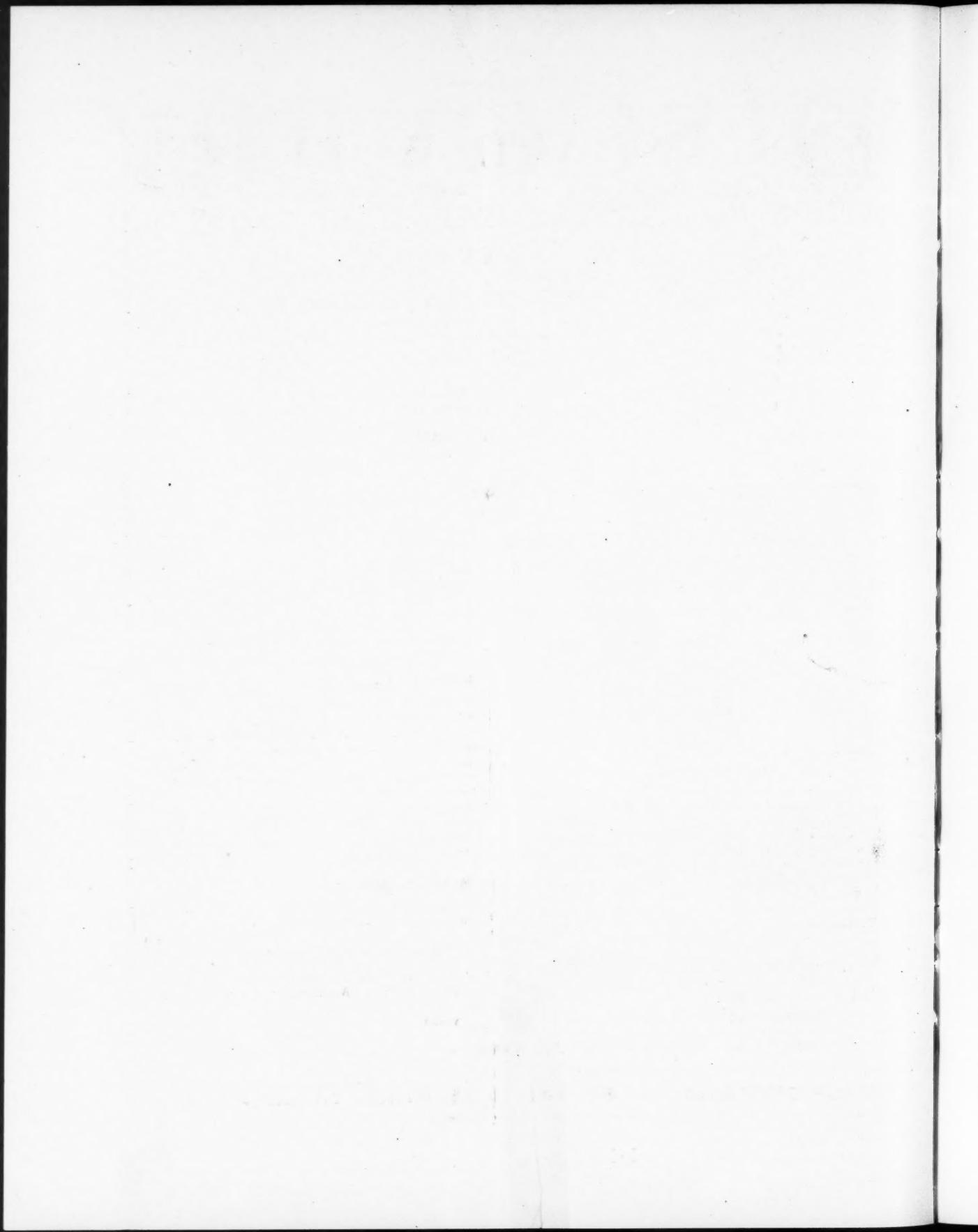
THE SCENE OF RECENT AND REMARKABLE
DISCOVERIES IN PREHISTORIC ART

One of the Colombière Caves in Southern France

CONTENTS

| | PAGE |
|--|------|
| EDITORIAL NOTES | 141 |
| SOME NEW DISCOVERIES IN PRE-HISTORIC ART | 143 |
| George Frederic Lees | |
| TAXATION AND UNEMPLOYMENT | 145 |
| Prof. Douglas Knoop | |
| SOME RECENT WORK ON THE DUCTLESS GLANDS | 148 |
| Dr. Lancelot T. Hogben | |
| ANIMAL PETS IN ANCIENT GREECE | 151 |
| Prof. W. R. Halliday | |
| FERTILITY RITES IN MODERN EGYPT | 154 |
| Winifred S. Blackman | |
| IMPERIAL WIRELESS COMMUNICATIONS | 158 |
| Lieut.-Col. C. G. Crawley | |
| BIOLOGY IN SHAKESPEARE—II | 160 |
| Prof. D. Fraser Harris | |
| REVIEWS OF BOOKS | 163 |
| A New Account of the Palæolithic Period—Communication with Spirits, etc. | |
| BOOKS RECEIVED | 166 |
| CORRESPONDENCE | 166 |
| The Invention of the Pilot Cable—The Problem of Personality. | |

JOHN MURRAY, 50A ALBEMARLE STREET, LONDON, W.1.





DISCOVERY

A MONTHLY POPULAR JOURNAL OF KNOWLEDGE

Vol. III, No. 30. JUNE 1922.

PRICE 1s. NET.

DISCOVERY. A Monthly Popular Journal of Knowledge.

Edited by EDWARD LIVEING, B.A., Rothersthorpe, Northampton, to whom all Editorial Communications should be addressed. (Dr. A. S. RUSSELL continues to act as Scientific Adviser.)

Published by JOHN MURRAY, 50A Albemarle Street, London, W.1, to whom all Business Communications should be addressed.

Advertisement Office: 34 Ludgate Chambers, 32 Ludgate Hill, London, E.C.4.

Annual Subscription, 12s. 6d. post free; single numbers, 1s. net; postage, 2d.

Binding cases for Vol. II, 1921, are now ready. Price 2s. 6d. net each; postage, 9d.

Editorial Notes

WE feel sure that a consideration of certain aspects of the Genoa Conference will not be out of place here. The particular political and economic questions which have been deliberated at Genoa—the treaty of Rapallo, for instance, or the problem of Russia's payment of her debts to ourselves and France—are not the concern of these notes. What does concern us is the historical significance of the Conference. Whatever its eventual results, the Conference will have been symptomatic of a steadily growing international consciousness. On more than one occasion we have commented on this striking tendency of the new era upon which we believe we are entering. What lies at the back of these conferences, of these attempts by the great nations to harmonise their conflicting interests? An idealism, surely, matured by two vital realisations—that the nations of the world, and in particular the United States of Europe, to use a term coined by Mr. H. G. Wells, are so closely bound together by financial and economic ties, that open co-operation between them is essential; and that another great war using ten times the destructive material of the last may deal a death-blow to our already sorely wounded and slowly recovering civilisation.

To state these two realisations to-day is almost to state two platitudes. Especially is this true of the second realisation, which, however, as a scientific journal we desire to consider from a particular angle. This is the question of the part likely to be played by scientists in the next war on a grand scale. In certain quarters there is a semi-conscious hostility towards "scientists" in general for the horrors which they contributed to the recent war. Yet, setting aside the first employment of gas by the Germans, how far can they be considered as responsible for these horrors? As the war continued the younger active men of every nation found themselves defending their own country according to the best of their mental and physical abilities and thus necessarily acting as cogs in the general machinery of destruction and violence. It is very questionable whether you can blame the man who invented a new deadly gas more than the man who despatched it to the enemy's lines in a shell. In the mental turmoil of war both believed that they were acting for the best, in the interests of their country, or in those of civilisation.

* * * * *

We are conscious that the ethical point here raised is exceedingly deep and difficult of decision. What is certain, however, is that circumstances originally caused by men are eventually stronger than men themselves. A writer stated¹ some months back: "It would be a very inspiring sight if the scientists of all civilised peoples were to become 'class-conscious' to the extent of laying a ban of excommunication from their academic and professional unions on any one of their number who, in peace or war, should aid a government to prepare or carry out its acts of mass murder. We can just conceive the passing of some such resolution at an international scientific congress, but we should doubt the probability of its observance when the strain of nationalist passion was felt, and we should expect, at the least, that the 'blacklegs'

¹ See article on *The Conscience of Science* in THE NATION AND THE ATHENÆUM for September 17, 1921.

would be numerous." This is to our mind a fair statement of the case, and, even were scientists to stand out of the next war as a solid body of conscientious objectors, the munitions already producible by the factories are terrible enough.

* * * * *

Such a revolution by scientists could never act, even at its best, as more than a narcotic. To kill the disease of war we have to cut at its roots. We believe that that is how most scientists view the matter, and why they—the predestined and unwilling instruments of torture—cannot but welcome any move to sift and reconcile national passions, and to prevent further wars. This attitude was apparent at the meeting of the British Association last September. The vistas of future knowledge and prosperity which scientific research is rapidly opening up are more visible to the eyes of the researchers than to anyone else ; and the value of a long peace to attain those vistas is, we are certain, most intensely felt by a class of men who are as humane as they are human.

* * * * *

An important point which crops up in connection with these international conferences, and which is sure to gain the increasing attention of statesmen and civil servants as international relations become more definite, is the matter of a common language for their facilitation. Undoubtedly much friction was caused at Versailles in 1919 with regard to this problem, which was, as a matter of fact, eventually solved by holding the meetings of the "Big Three" in English, the meetings of the "Big Five" in French and English, and the public meetings chiefly in French. Again, the babel of Genoa has required the most brilliant linguistic talents to reduce it to any kind of order, and a great deal of time has been inevitably wasted in interpretation. Professor Guérard, a very able French scholar, has lately written a most stimulating book on the subject of international languages.¹ He advocates the gradually expanding employment of a common language which would not "supersede the existing national tongues any more than the League of Nations is meant to absorb the existing national States," but which would act as a "mere auxiliary."

* * * * *

Is there any language suitable for this purpose ? In an endeavour to answer this question Professor Guérard has divided his book into three parts, covering in the first the natural languages at our disposal, in the second the artificial, and in the third some summaries of the two foregoing parts and the anticipations to which they give rise. From the languages of Western civilisation Professor Guérard selects two as

predominant and most ideal for expansion—French, largely on account of its past and present use as a diplomatic and commercial language and for its elastic qualities of expressing thought, and English largely on account of the power and wide diffusion of Anglo-Saxon races in the world. He points out that a condominium of these two languages might serve the purpose of a *lingua franca*. "This means nothing more than organising a spontaneous development, accelerating an evolution already well under way. If, by some diplomatic agreement, the teaching of French were made universal in the British Empire and in the United States, whilst all students in France were required to learn English, an immense progress would be realised. Two hundred million men would have a direct means of communication ; the rest of the world, instead of remaining perplexed before the multiplicity of languages, would have only two to master." But the professor is farsighted enough to realise that "in a democracy of nations, the claims of the 'great powers' will never be whole-heartedly conceded and the distinction between major and minor languages likewise will ever remain offensive."

* * * * *

Again, the claims of Latin, taught throughout the schools of Europe, come before us, but are rendered of little account for the reason that the language is dead and favours invidiously those nations which speak Romance tongues. Professor Guérard turns to the artificial languages for a solution. Out of the hundred or so projected, half-completed, and completed systems, he selects Esperanto for its practical success, but states that "the final solution seems to us to lie between the dialect of Zamenhof, too hybrid and arbitrary, and that of Peano, too irregular in its 'naturalness' ; more precisely between Ido and Romanal." It is in such a "Cosmoglotta," as he terms the international language which might result from this combination, that Professor Guérard looks for the salvation and progress of mankind. We find it difficult to share the author's optimism, yet we recommend his book for its extremely suggestive and stimulating qualities.

* * * * *

A considerable amount of correspondence has reached us as the result of the Editorial Notes in our March number suggesting the establishment of a commission to inquire into the problem of personality. It is apparent that, apart from its other functions, DISCOVERY is becoming a channel of expression for the thoughts and ideas of a large intellectual portion of the British public, and of its attitude to, and interest in, scientific research. That attitude, we consider, should be given a wide hearing, and DISCOVERY intends to give it—in its editorial notes and correspondence columns.

¹ *A Short History of the International Language Movement*, by A. L. Guérard. (T. Fisher Unwin, Ltd., 21s.)

Some New Discoveries in Prehistoric Art

By George Frederic Lees

It was recently announced in the daily press that two French *savants*, Dr. Cuguillière and M. Bacquié, had made some striking discoveries bearing on prehistoric art in the caves of the Valley of Ussat, in Southern France. Specimens of rough pottery and drawings, tombs with funeral urns and designs cut in the rock, and certain curious red signs engraved upon the white and ochre walls were reported to have been brought to light. "Remarkable relics of the Stone Age, including primitive sketches of animals—horses and mountain goats drawn with skill," the newspaper account proceeded to announce in a manner apt to mislead those who take a serious interest in palaeontological research.

The above announcement, which was necessarily unaccompanied by documentary evidence in the form of photographs or sketches, is a case in point. Quite unintentionally, the importance of the new discovery in the country of the "Roches de Feu" has been exaggerated. The Abbé H. Breuil, of the Institut de Paléontologie Humaine, Paris, the leading French authority on Prehistoric art, and one of the contributors to that fine series of illustrated volumes published under the general title of *Peintures et gravures murale : des Cavernes paléolithiques*, visited Ussat in September of last year ; but in his opinion the discoveries, though certainly interesting, are very modest ones. His report—"un petit travail"—will not be ready until next summer, he writes to me, and he very much doubts whether the contents merit being brought to the knowledge of the general public.

There are, however, recent discoveries in the realm of prehistoric art which are well worth bringing to the notice of English palaeontologists. I refer to those made by Dr. Lucien Mayet, of the anthropological section of the University of Lyons, and M. Jean Pissot in the Colombière caves near Poncin, in the Department of Ain. These diggers came across there a complete workshop of an Aurignacian engraver, including numerous specimens on limestone blocks and bones, lying side by side with numerous flint tools with which the artist of the Reindeer Age did his engravings. In close proximity were flat-surfaced blocks, probably used as seats ; and the hypothesis is that the workers were obliged to abandon their *atelier* through a sudden rising of the waters of the adjoining river Ain, since tools and artistic productions were found to be covered with fine sand from the river-bed.

Some of the most interesting of the prehistoric

drawings brought to light included two human figures engraved on a mammoth bone, a man stretched on his back with one arm raised vertically, and above, turned to the right, the unfinished silhouette of a woman. Whereas the figure of the man, with his big head, long thick nose, and hairy chin and body, gives the impression of brutality, that of the woman is expressive of grace—in brief, the figure of a veritable Venus of the Stone Age compared with the extraordinarily developed women represented by the well-known Aurignacian sculptures of Brasempouy, Villendorf and Laussel. Two other drawings were on the same piece of bone ; one of a bear, the other of a stag's antlers. It is claimed by the authors of this discovery that we have here an instance of the earliest known engraving of the human figure on mammoth bone—a contention which has given rise to a certain amount of discussion, in which it seems to me MM. Mayet and Pissot have the best of the argument.

The engravings on limestone represent a whole series

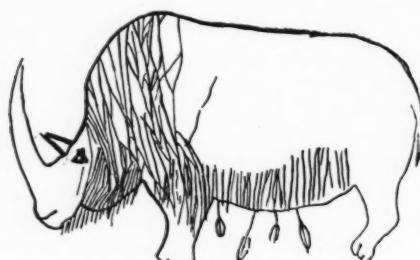


FIG. 1.—THE COLOMBIÈRE CAVE NEAR PONCIN (AIN), ONE OF THE TYPICAL PREHISTORIC CAVES OF FRANCE.

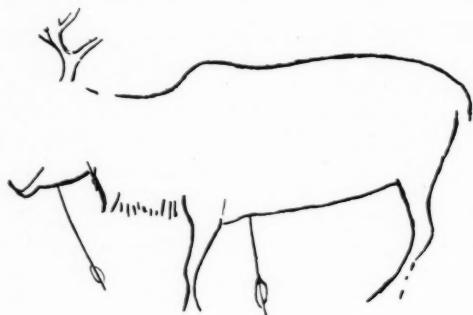
of animals. On one stone are a chamois, a stag's head, a felid and other animals of doubtful nature ; on another is a fine representation of the head of a galloping horse, with its mane streaming in the wind—certainly the best

of the engravings of the Colombière caves; on a third stone is the complete engraving of a rhinoceros with a series of arrows hanging from its belly. Prehistoric figures of animals similarly pierced with arrows have been found in other caves in France, notably at

Reinach among them—believe that these cave pictures were connected with magical practices. But with this theory M. Marcellin Boule, the Director of the Institute of Human Palaeontology, of Paris, cannot quite agree. In his opinion we have here the earliest



Rhinoceros, with arrows.



Stag, with two arrows.



Stag.



Figure of horse with flowing mane, engraved on limestone.

FIG. 2.—TRACINGS OF ENGRAVINGS FOUND IN THE COLOMBIÈRE CAVES, AIN, FRANCE.

Chaffaud (Vienne), at Eyzies (Dordogne), and at Mieux (Ardèche). Finally, there was another incomplete but finely executed engraving of an animal which, after the Abbé Breuil had given his opinion upon it, was identified as a musk-ox, which has rarely been depicted by artists of the Reindeer Age.

Contemplation of these and similar drawings or sculpture has given rise to much speculation regarding their use and meaning. Dr. Mayet apparently inclines to the belief that these animal pictures may have been used as talismans, capable of assuring the fortunate possessor of a fruitful day's hunting. Many prehistorians—and that eminent authority M. Salomon

instances of art for art's sake, though he does not deny that they may have had a slight connection with magic.

BIBLIOGRAPHY

- W. Boyd Dawkins: *Cave Hunting, researches on the Evidence of Caves respecting the Early Inhabitants of Europe.* (Macmillan & Co., 1874.)
- Dr. Lucien Mayet and Jean Pissot: *Abri-sous-roche préhistorique de la Colombière, près Poncin (Ain).* (A. Rey, Lyons.)
- Marcellin Boule: *Les Hommes Fossiles : Éléments de Paléontologie Humaine.* (Masson et Cie, Paris, 1921.)

Taxation and Unemployment

By Douglas Knoop, M.A.

Professor of Economics in the University of Sheffield

THE purpose of this article is to examine the connection between taxation and unemployment. Though students of the problem of unemployment have paid little or no attention until recently to the possible influences of taxation, students of public finance have always contemplated the possible discouragement to industry and trade which might be brought about by unwise or excessive taxation. This point was emphasised by Adam Smith as early as 1776.¹ In stating his fourth maxim of taxation, he noted that a tax "may obstruct the industry of the people, and discourage them from applying to certain branches of business which might give maintenance and employment to great multitudes." Subsequent writers on public finance have all laid stress on this so-called canon of economy, with a distinct tendency to emphasise its importance even more than was done by Adam Smith.

That it is theoretically possible to crush an industry almost, or entirely, out of existence by means of high taxation must be admitted; an actual case is noted in the Poor Law Report of 1834, viz. farming in the parish of Cholesbury in Bucks. Whilst the population was almost stationary from 1801 to 1831, the rates had increased from £10 14s. at the end of the eighteenth century to £99 4s. in 1816, and to £150 5s. in 1831. In 1832 the attempt was made to collect rates amounting to £367, but it proved an impossibility as the landlords gave up their rents, the farmers their tenancies, and the clergyman his glebe and his tithes. Thus the whole parish was abandoned owing to excessive rates and the labourers were thrown out of employment.

The connection between taxation and unemployment in this country at the present time does not appear to be exactly of this character. Roughly, it seems possible to distinguish two types of cases: in the first, the prevailing depression in trade is having an unfavourable influence on taxation; in the second, taxation is having an unfavourable influence on the depression in trade, but probably rather by checking a recovery than by actually causing unemployment. I propose to examine these two types of cases in turn.

I

1. A tax is not always paid finally by the person or firm from whom it is collected; the payer in the first instance may succeed in shifting it on to someone with whom he has economic relations, e.g. a tobacco manufacturer probably shifts the tobacco

duty on to the tobacconist, who in his turn passes it on to the smokers in the form of an enhanced price. The problem as to who finally pays a particular tax is often very complex, and I must content myself here with drawing attention to one consideration. When the demand for the products of industry is slack, it is always much more difficult to shift the final payment of taxes on to buyers than when the demand is keen. Consequently, at the present time, owing to the great falling off in the demand for many products, it is probable that business firms have to pay finally a bigger share of rates and taxes than was the case a year or two ago.

2. Both individuals and business firms, in so far as they finally pay taxes, regard taxation as involving a sacrifice or burden, because it compulsorily deprives them of part of their resources in return for somewhat remote and indefinite services, the value of which does not appear to them to be worth the sum paid in taxation. The extent of the burden or sacrifice would appear to depend largely upon the use which the taxpayers could have made of the sums paid in taxation, had these remained in their possession. At this point it is necessary to distinguish between the cases of private individuals and of business undertakings. The larger the income of an individual, the less urgent do the wants tend to become which he is prevented from satisfying because of taxation. Consequently £3,000 taken in taxation from a person with £10,000 a year probably causes less sacrifice than £300 taken in taxation from a person with £1,000 a year. In so far as taxes do finally rest upon business firms, e.g. income tax on sums placed to reserve, the mere size of the resources affected by the taxation appears to be no indication of the urgency of the wants which could have been satisfied, had the sums taken in taxation been available for use at the discretion of the firms concerned. One firm paying £30,000 income tax in respect of £70,000 placed to reserve may be in a far better position to use the money, and in far more urgent need of it, than another firm paying £3,000 income tax in respect of £7,000 placed to reserve.

At the present time practically all firms are in need of liquid resources for business purposes, and the drain of ready money involved by taxation payments is particularly burdensome. At times when resources are more liquid, or when credit is more easily obtained, the burden of taxation is not so severely felt.

3. Owing to the fall in the general level of prices associated with the depression in trade, and the consequent increase in the purchasing power of money, rates of taxation have automatically become heavier in certain cases. Thus specific customs or excise duties, like those on spirits, beer, tobacco, tea, and sugar, represent more to would-be buyers to-day than

¹ *Wealth of Nations*, Book V, chap. ii, part 2.

they did a year or two ago. Looking at the problem in another way, the large fixed duties which enter into the selling prices of certain articles prevent the prices of these articles from falling in approximately the same proportion as the prices of non-taxed articles are falling, and thus discourage sales to the detriment of the manufacturers and dealers concerned.

4. The sudden depression following on a period of steadily improving trade has led, in many cases, to increased assessments for income tax at a time when profits are seriously reduced. The full effect of the various rises in income tax during the war had probably not been felt by business firms prior to the recent slump, as the assessments were based on the average profits of the previous three years, which, owing to improving trade, tended to be lower than the actual profits of the year in which the tax had to be paid. We may suppose that X. & Co. had profits of £10,000 in 1917, £12,000 in 1918, £20,000 in 1919, and £30,000 in 1920. In January 1921 they would be called upon to

$$\text{pay income tax on } \frac{\text{£10,000} + \text{£12,000} + \text{£20,000}}{3} = \text{£14,000}$$

at 6s. in the pound, i.e. £4,200. This sum would probably be paid out of the profits of 1920, and represents only 2s. 9 $\frac{2}{3}$ d. in the pound on £30,000 profits. The following year the position would be quite different, owing to the sudden slump. In 1921 we will suppose that X. & Co. made a profit of £5,000. At the beginning of 1922 they would be called upon to

$$\text{pay income tax on } \frac{\text{£12,000} + \text{£20,000} + \text{£30,000}}{3} = \text{£20,667}$$

at 6s. in the pound, i.e. £6,200. This sum exceeds the actual profits of 1921, representing a tax of £1 4s. 9d. in the pound. At first sight this appears to be an appalling hardship; it is known, however, to all business men that under the three-year average system income tax payments work out lightly in years of improving trade, and heavily in the years of declining trade, especially in the first year after trade has begun to decline, so that it is very desirable in good years to place sums to reserve to meet income tax payments in bad years. Even if this precaution has been taken, the making of the income tax payment will be a cause of difficulty, unless the income tax reserve is in a liquid form. It must also be remembered that under the three-year average system the total amount paid in income tax over a long period of years works out to very much the same sum as if the tax on each occasion were based on the profit of a single year, only the fluctuations in the amount due each year are less violent under the averaging system.

Where firms are privately owned, the partners are subject to super-tax as well as to income tax. The amount of a taxpayer's income for super-tax purposes is, roughly speaking, the amount of income on which

he has borne income tax the previous year. Thus super-tax figures lag even further behind current profits than do income tax figures. If X. & Co., of the previous paragraph, belonged to one man he would in January 1922 be paying income tax on £20,667 (average for 1918, 1919, and 1920) and super-tax on £14,000 (average for 1917, 1918, and 1919). The necessity to accumulate liquid reserves to pay super-tax during a depression in trade is as great as it is in the case of income tax.

II

We must now turn to the other side of the picture and consider the effects which high taxation may have on the depression in trade. I propose to distinguish five cases, three of which may be described as material and two as psychological.

1. High taxation tends to diminish the opportunities to save, thus restricting the flow of new capital which is so essential as a stimulant to trade and industry. So far as the individual is concerned, it is sometimes urged that, the higher the rate of taxation, the greater the effort that will be made to save for future uses, because, the higher the rate of taxation, the larger the gross income that will be necessary in the future in order to yield a preconceived net income after payment of taxation. It is doubtful, however, whether many individuals look at the problem in this way, and, even if they do, whether, after paying their taxes and meeting what they regard as necessary expenditure, they are in a position to save more than formerly. So far as a business firm is concerned, the prejudicial effect on saving, of high taxation which cannot easily be shifted, appears to be unquestionable. "Saving," in the case of a firm, consists in reserving sums out of current profits for use in developing and expanding the undertaking. Sound finance undoubtedly calls for the accumulation and use in the business of such reserves, yet in the case of a privately owned firm income tax and super-tax, and, in the case of a public company, income tax and corporation profits tax, make very heavy inroads into the profits and greatly reduce the sums available for financing developments.

2. High taxation tends to discourage the provision made for wear and tear of plant, machinery, etc. Allowing repairs and renewals to fall into arrear not only reduces the productive capacity of the industry concerned in the future, but prejudices in the present the trades with which the renewal orders would have been placed. It is more especially high income tax which discourages proper provision for depreciation, because the sums which the Inland Revenue allow firms to charge as expenses on account of depreciation, in ascertaining their incomes for income tax purposes, tend to be considerably less than the actual cost of repairs and renewals. Thus, repairs and renewals have

to be financed to a considerable extent out of profits subject to income tax. When £1,000 of profits are required to pay for £700 of repairs, firms are loath to carry out more than the most urgent repairs.

3. It is claimed by many authorities that certain new taxes, especially those levied in connection with the Safeguarding of Industries Act, are impeding foreign trade, not merely by the imposition of a 33½ per cent. tax which formerly did not exist, but by the uncertainties and petty quibbles to which that Act has opened the door.

4. The chief psychological effect of high taxation appears to be to promote pessimism and to discourage enterprise amongst business men. There can be no question that all business transactions involve risks and that the uncertainty now prevailing about price movements makes the risks bigger than usual. If business risks are successfully negotiated, the Government, through taxation, takes a substantial slice of the resulting profits; whereas, if the risks prove too great and losses are incurred, the Government does not fully share them. The business community, in many cases, appears to feel that the game is not worth the candle under present circumstances and prefers to wait for more favourable conditions before launching out. The prospect of retaining a bigger share of profits, if made, would probably act as an incentive to adopt a more enterprising policy.

5. A second psychological effect of high taxation is that it tends to diminish the incentive to work, and in certain cases, at least, will lead to less work being done. An individual is prepared to do a certain amount of extra work for the sake of earning an extra pound, but if that pound is reduced to 17s. or 14s. by the deduction of 3s. or 6s. income tax, the incentive will be less. He may do the extra work, nevertheless, for the sake of maintaining his standard of life, or he may do some of the extra work, preferring his leisure to doing the last and most disagreeable part of it; or he may do none of the extra work, so as entirely to escape the tax liability which would accrue on his income passing a certain sum. It is certainly commonly believed that miners fairly recently, if not at present, have deliberately refrained from work, when the pay corresponding to that work would raise their incomes above the exemption limit of the income tax. Reduced output, whether brought about by this or any other cause, tends to increase the cost of production and penalise all industries which have to use the restricted output.

III

Whilst it is conceivable that a particular industry or even business generally, might be almost taxed out of existence, it fortunately does not appear as if such an acute position had been reached in this country.

*

The situation here may perhaps be summarised by saying (1) that the prevailing depression has tended to augment certain taxes; and (2) that high taxation is tending to aggravate the problem of unemployment which has been primarily caused by other circumstances.¹ It is somewhat doubtful as to how far a modest reduction in taxation would help to stimulate employment. Anything more than a modest reduction in taxation is almost inconceivable in view of the position of the national finances; even a modest reduction might prove very embarrassing, though it has to be remembered that, if it really succeeded in stimulating trade sufficiently, the reduced taxes might yield as much with improved trade, as the higher taxes would with more depressed trade. If taxation were reduced and the revenue suffered, we must briefly consider how the Government could hope to make both ends meet.

1. The sums provided in the Budget for the repayment of debt might be curtailed, or even eliminated, for the time being. Unfortunately, since the Armistice, there has been no reduction of debt out of taxation revenue; such debt reduction as has been achieved has been financed out of the sums obtained from the sale of surplus stores, etc., and some of these sums, which are really capital and not income, have had to be employed to meet current expenditure. As nothing has been raised by taxation for the repayment of debt, there is no relief to be found in that direction.

2. Some services, which are at present paid for out of taxation, might be defrayed instead out of borrowed money. Financially, this would be one step worse than meeting current liabilities out of the proceeds of the sale of surplus stores, etc. When we remember that our international credit and the movements of the Foreign Exchange depend very largely upon the soundness of our national finances, it is difficult to approve of this extreme step as a deliberate policy.

3. Sufficient economies might be effected in national expenditure to enable taxation to be reduced. The difficulty here is that a very big reduction in expenditure is required to make both ends meet in 1922-3, without any question of managing with less taxation revenue, so that this solution does not appear to offer very much prospect of relief.

The authorities are faced by a choice of evils: to reduce taxation and jeopardise the national finances; to maintain taxation and jeopardise trade recovery. The one comforting thought in the dilemma is that this is a case where it is not necessary to plump solidly in favour of one course or the other; a solution may possibly be found in some kind of compromise.

April 29, 1922.

¹ See my article on *The Problem of Unemployment* in *Discovery* for November 1921.

Some Recent Work on the Ductless Glands

By Lancelot T. Hogben, M.A., D.Sc.

Imperial College of Science and Technology

IT is a matter of common knowledge that the nervous system directs into appropriate channels of response the stimuli which an animal receives from its surroundings. But the nervous system does not constitute the sole mechanism known to be instrumental in co-ordinating the behaviour of the organism. During the past twenty-five years it has been increasingly recognised that, as Brown Séquard was among the first to foresee, the blood stream provides an alternative channel by which chemical compounds produced in one part of the body may evoke a reaction in another organ remotely situated with respect to it. As an illustration a discovery made at the beginning of this century by Bayliss and Starling will serve. When food is presented to an animal like the dog, it secretes saliva; nervous impulses pass from the organs of vision, taste, or smell to the brain, and are directed thence into the motor nerves which stimulate the salivary glands to activity. Similarly, when food enters the small intestine, the digestive gland known as the pancreas begins to secrete actively. But the way in which this organ is activated is entirely different. The acid food coming from the stomach acts upon a substance present in the intestinal wall to set free a compound called by Bayliss and Starling "secretin." This *secretin* diffuses into the blood stream, and is carried sooner or later to the pancreas, on which it has a specifically excitatory action.

Such chemical messengers are spoken of as *hormones*. And there exist in the body a number of organs whose unique function is to regulate various activities by setting free into the blood stream hormones or internal secretions which act specifically either in producing such immediately visible responses as muscular movement or secretion in other organs or the more subtle form of regulation involved in the growth processes. Such structures are known as ductless or *endocrine* glands. Two of the most important of the ductless glands are the *thyroid*, situated on the ventral side of the throat, and the *pituitary*, encased in a depression of the skull at the base of the brain. Both glands are of the utmost medical importance; but they are also significant to an understanding of some of the most baffling problems of animal physiology; and it is the purpose of this article to outline some recent discoveries relating to the function of the thyroid and pituitary glands which open up wide fields for inquiry though not of themselves directly utilitarian.

The interest of biologists became focused on the

question of internal secretion in its non-medical bearings, especially through a discovery made ten years ago by Gudernatsch. This worker experimented with dieting tadpoles of the common frog on various kinds of tissue such as brain, liver, etc., including the ductless glands such as the thyroid. He employed an enormous variety of tissue foods, and he found that, with the exception of those individuals which were brought up on a thyroid diet, the tadpoles grew at much the same rate and transformed into frogs at about the same time as they do in natural surroundings. The tadpoles reared on a thyroid diet were, however, quite exceptional in transforming into frogs at a much earlier date and long before attaining the dimensions with which metamorphosis is ordinarily associated. How potent is the thyroid tissue in effecting the change may be judged from the result of later experiments by Swingle (1918) on the large American frog *Rana catesbeiana*, which, unlike our own species, takes three seasons in the ordinary course of events to reach the adult condition. Fed on fresh thyroid gland *Rana catesbeiana* will complete its larval life and transform into a pygmy frog at the age of six weeks.

Gudernatsch's discovery was soon confirmed by the observations of several other workers—Morse, Barthélémy, and Swingle—who obtained corresponding results with other larvae of amphibians (toads, newts, salamanders, etc.). It does not in itself establish a relation between the thyroid gland's activity and the transformation of the tadpole into the frog; for the thyroids used in the experiments were taken from sheep and oxen—animals widely separated from the frog and its allies. However, the facts which had been elicited stimulated other workers to explore the ground more thoroughly. Bennet Allen, an American zoologist, succeeded (1916-18) in overcoming the technical difficulties of removing the thyroid from tadpoles of the toad. The delicate operation of extirpating the rudiment of the thyroid from very young larvae was carried out with a cataract needle under a microscope. The wound produced heals within an hour, and fortunately the amphibia are free from susceptibility to septic poisoning. Tadpoles deprived of their thyroids at this early stage grow in a perfectly normal manner, until they reach the age at which metamorphosis would be expected to occur. Instead of undergoing transformation at this juncture into the adult form, they retain their gills and tails, the forelimb rudiments fail to break through the skin, and the animals continue to grow, attaining dimensions far exceeding those of the ordinary tadpole. In short, they lack the power to undergo metamorphosis under normal conditions. Thyroidless tadpoles do nevertheless complete their development and emerge from the larval phase, if, as Swingle was able to show later (1918), they

are fed with thyroid tissue. This discovery of Allen's was soon afterwards confirmed by the work of E. R. and M. M. Hoskins. And we may say at this point that the behaviour of the thyroidless tadpoles completes the evidence for regarding the activity of the thyroid gland as an essential factor in controlling the metamorphosis of the frog and its allies.

This fact is of considerable interest to those who are concerned primarily with the physiology of development and growth. But the metamorphosis of the tadpole has an ulterior significance which is related to important questions in human physiology. That the thyroid is a ductless gland was first established by the discovery that the condition of arrested physical and mental growth (cretinism) in children associated with thyroid deficiency is remediable by injection, implantation, or feeding with thyroid gland substance. For many years it has been known that the thyroid contains a higher percentage of the element *iodine* than any other portion of the body; and iodine compounds have been administered medicinally in thyroid disorders. The precise significance of the connection between iodine and the thyroid has been the subject of much controversy. Some have regarded the presence of iodine in the thyroid as unimportant; others have held that the thyroid hormone (or *autacoid*) is an iodine compound. It is, of course, impossible to traverse the intricacies of this discussion in this article. It is sufficient to say that the study of the transformation of the tadpole into the frog has heavily weighted the scales in favour of the latter view.

Soon after Gudernatsch's observations appeared Morse succeeded in obtaining similar results with the use of *iodised* blood albumen; and Lenhart (1916) was able to show that the rate of metamorphosis in tadpoles fed on thyroid diet depends on the iodine content of the glands used. These observations led to a brilliant series of inquiries by Swingle (1918-20), who proved that iodine (free of organic combination) administered either with the food or dissolved in the water will not only induce, like thyroid substance, a precocious metamorphosis in normal larvae, but will also enable thyroidless tadpoles to complete their development. Frog tadpoles can be made to complete their metamorphosis even when deprived of their thyroids, if a sufficient quantity of iodine is supplied to them. The same is true of salamander larvae (Uhlenhuth). Thus in these creatures the thyroid acts as a storage organ for iodine, accumulating the latter as the immature larva grows from the minute traces of iodine in their normal food, and eventually liberating it in the form of a highly active substance which, circulating in the blood stream, leads to the destruction of the larval characters (gills and tail) and to the growth of the forelimbs and other adult features.

It has been mentioned that the relation of the

thyroid to metamorphosis has been established in newts and salamanders as well as in frogs and toads. These tailed amphibians also start their free life with a bodily organisation very different from that of the adult form; but the details are not quite the same. In newts and salamanders the metamorphosis is less abrupt; they are hatched from the egg with limbs fully developed; and they do not—like the tadpole—possess a gill-cover of *operculum*. In its place there arises on either side of the head, as in the very young frog tadpole, a tuft of filaments, the external gills. Metamorphosis essentially consists in the loss of these gills and the fin which runs along the back and either

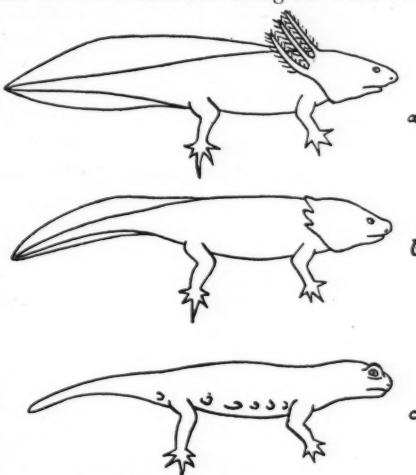


FIG. 1. A. Axolotl larva.
B. Intermediate stage after a fortnight's thyroid feeding.
C. The fully developed Mexican Salamander.

side of the tail, which latter passes over into the adult and is not destroyed as in frogs and toads. Sometimes these amphibian larvae fail in nature to transform at the ordinary time and assume sexual maturity while still in the larval state. This has become a permanent condition in the case of the Mexican salamander of certain localities. The "axolotl," or larva of the Mexican salamander, never leaves the water, but reproduces from generation to generation in the gilled condition.

Naturally, when young specimens were imported from Mexico, reared to maturity, and bred in the Jardin des Plantes for the first time, in 1863, they were regarded as representatives of a small tribe of salamanders which retain the gills, etc., permanently throughout life like the blind cave newt *Proteus* of Dalmatia and the "hell bender" (*Necturus*) of North American rivers. It was found a year later that offspring of the same stock would, if the water dried up, shed their gills and tail fin, develop eyelids and yellow spots on the belly, and generally assume the appearance of a well-known American salamander of terrestrial habit. The transformation can be brought about by less drastic means and with infallible regularity

in a comparatively short time (three to four weeks) when axolots are fed on raw thyroid gland from the ox. This was first shown independently by Laufberger (1913) and Jensen (1917), whose work was later confirmed and extended by Huxley and Hogben (1920).

Now there is an interesting circumstance relating to the thyroid-induced metamorphosis of the axolotl which has emerged from the work of the last-named. Iodine has no effect whatever on this species. This appears to indicate that the thyroid of the axolotl is not in working order, though as a matter of fact it is structurally well developed. Does the thyroid gland of the amphibia store iodine and secrete thyroid hormone continuously, or does the activity of the thyroid depend intimately upon internal stimuli? This question leads us on to a consideration of the other important ductless gland mentioned earlier in this article, namely the *pituitary*.

In the tadpole the pituitary gland which arises as a vesicle of tissue budded off from the roof of the mouth is not fully differentiated at the time of hatching, and it is possible to remove it by the neat insertion of a fine needle without fatal consequences. The technique of this operation was perfected by Bennet Allen (1917) at the same time as his experiments on thyroid removal were in progress, and the results obtained by him have been confirmed by two other workers, Smith and Atwell, who have conducted inquiries on similar lines. Large numbers of pituitaryless tadpoles have now been reared, and the most significant feature they display for present purposes is that they show a retardation in the development of the thyroid, and—like thyroidless tadpoles—a failure to metamorphose. Later Allen (1920) and Swingle (1921) have published preliminary indications of the possibility of inducing metamorphosis precociously by ingrafting the pituitary gland of other individuals into normal tadpoles.

Here the pituitary gland, or, to be more precise, its anterior portion, seems to exercise an influence on development as well as the thyroid; and recently the writer (Hogben) has induced Axolotls to transform by injections of pituitary extracts. Its precise function in man and the higher animals is not understood, though clinical evidence points to a connection with growth. Of its posterior half much more is known. This portion of the pituitary secretes a hormone (or more probably a group of hormones) which assist in regulating blood pressure, child labour, and the flow of the milk by excitatory action on involuntary muscle and glands. One of these hormones plays an important rôle in regulating the colour of the tadpole.

Most readers will be familiar with the power of certain animals, such as fishes, amphibia, reptiles, and some molluscs, to respond to stimuli—in some cases to the colour of their surroundings—by appropriate changes of colouring of the skin. The chameleon, whose

aptitude in quick-change artistry is perhaps a little exaggerated, is the proverbial example; but more familiar animals like the trout and frog are capable of considerable pigmental changes in quite a short time. A frog that has been kept in the shade and exhibits a coal-black tint will within an hour of removal to white flagstones in the sun develop a pale yellow or flesh-coloured hue. Colour changes of this nature are brought about by the contraction and expansion of certain corpuscles charged with pigment granules and situated near the surface in the skin.

The responses of these microscopic pigment cells are in certain cases adaptive, being co-ordinated in such a way as to render the animal inconspicuous among its surroundings. This is well seen in the case of albino axolotls which have very little pigment, and, if kept in a tank with white glazed sides illuminated from above, remain perfectly white. When transferred to a container with blackened sides similarly illuminated from above, they become in a very few minutes quite dark. This change will not, however, take place in animals whose eyes have been removed, blinded, or covered with an opaque substance. The response—"colour adaptation"—depends upon the appropriation of stimuli by the retina. Nervous impulses probably pass from the brain direct to the pigment cells. But in all probability an important factor in regulating colour change is brought about more in directly by increased secretion of certain of the ductless glands.

Of these the posterior portion of the pituitary gland is of the utmost significance. The frog tadpole is usually dark, in fact black, in colour. Allen and other workers agree in stating that after pituitary removal their tadpoles assumed a pale silvery appearance. This extreme pallor was found, on microscopic observation, to be due to the contraction of the pigment cells. The nature of the symptoms of pituitary removal points to the conclusion that the secretion of this gland maintains the pigment cells in an expanded condition under normal circumstances. This has been directly verified quite recently by Hogben and Winton (1922), who have found that an adult frog can be changed from a pale yellow to a coal-black tint within twenty minutes by injection of an extract equivalent to less than a hundred thousandth of a gram of the substance of the posterior portion of the pituitary.

The secretion of another gland (suprarenal), lying in man above the kidney and acting on involuntary muscle in a manner somewhat similar to the pituitary hormone, when administered to fishes or amphibia alike induces a sharp contraction of the pigment cells, the animal becoming extremely pale. A similar result follows treatment with extracts of another organ—the *pineal body*, at least in the case of tadpoles. The pineal is a small structure lying on the roof of the brain. In some forms—for instance, the archaic New Zealand

lizard, called by the Maoris "Tuatara"—it possesses an eye-like structure, as the researches of Professor Dendy have specially demonstrated, and it is highly probable that our reptilian ancestors possessed an additional eye on the top of the head, surviving to-day merely as a vestige in the pineal. The function of the pineal in modern forms has long excited inquiry. Descartes located the human soul therein, and medical men, whose observations have provided no confirmation for this hypothesis, have advanced reason for regarding it as a ductless gland. The effect of pineal extracts on frog tadpoles seems to imply that it forms a secretion of high physiological activity. McCord and F. Allen (1917), whose results were later confirmed (Huxley and Hogben), have shown that if fresh pineals are given as food to tadpoles, the animals begin to display marked colour changes following each meal after the treatment has been carried on for about a fortnight. Within a quarter of an hour of feeding they assume a ghostly pallor: the internal organs and skeleton are plainly visible through the skin, and they retain this uncanny condition for about two hours. To the observer the spectacle is reminiscent of some of Mr. Wells's descriptions in his story *The Invisible Man*.

In this brief survey we have confined our attention to some discoveries—almost exclusively made during the past five years—in connection with two problems of general interest to the student of animal life, colour adaptation, and development. Within the same period of time several important advances have been made in the medical field, and a vast realm of inquiry has been opened up in relation to internal secretion by the studies of Steinach, Lillie, Goldschmidt, and others, on the part played by the ovaries and testes (reproductive glands) in controlling the sexual characteristics of the organism. These discoveries are so far-reaching that they cannot be discussed apart from the whole body of modern work on sex determination. It may safely be said that the study of ductless glands is at the moment one of the most (perhaps the most) fertile fields of investigation; and the progress achieved of late is likely to prove the forerunner of great developments in biological science before many years have elapsed.

REFERENCES

Adler: (1914) *Arch. f. Entwicklungs Mech.*, 39 and 40.
 Allen: (1917) *Biol. Bull.*, 32; (1918) *Journ. Exp. Zool.*, 24; (1920) *Science*.
 Atwell: (1919) *Science*.
 Gudernatsch: (1912) *Arch. f. Entwicklungs Mech.*, 35; (1914) *Amer. Journ. Anat.*, 15.
 Hogben: (1920-22) *Proc. Zool. Soc.*
 Hogben and Winton: (1922) *Proc. Roy. Soc.*, B (in the Press).
 Huxley and Hogben: (1922) *Proc. Roy. Soc.*, B.
 Lenhart: (1915) *Journ. Exp. Med.*, 22.
 Morse: (1915) *Journ. Biol. Chem.*, 19.
 Swingle: (1918) *Journ. Exp. Zool.*, 24; (1919) *Journ. Exp. Zool.*, 27; (1919) *Journ. Gen. Physiol.*, 1 and 2; (1921) *Journ. Exp. Zool.*, 34.
 Uhlenhuth: (1919) *Journ. Gen. Physiol.*, 1; (1921) *Journ. Gen. Physiol.*, 3; (1922) *Biol. Bull.*, 42.

Animal Pets in Ancient Greece

By W. R. Halliday, B.A., B.Litt.

Professor of Ancient History in the University of Liverpool

A FREQUENT topic of our newspapers in the silly season is the questionable morality of the affection lavished by elderly spinsters upon their lap-dogs. There is nothing new under the sun. Plutarch begins his *Life of Pericles* with the following words: "Cæsar once, seeing some wealthy strangers at Rome, carrying up and down with them in their arms and bosoms young puppy dogs and monkeys, embracing and making much of them, took occasion not unnaturally to ask whether the women in their country were not used to bear children; by that prince-like reprimand gravely reflecting upon persons who spend and lavish upon brute beasts that affection and kindness which nature has implanted in us to be bestowed on those of our own kind."¹ As a matter of fact, the love of pets was not confined to strangers in Rome. Catullus wrote a famous poem to Lesbia's pet sparrow,² and Ovid celebrated in verse the obsequies of his mistress's parrot.³ But the moral reflection attributed to Cæsar is a commonplace of considerably older date than the first century B.C. and occurs for the first time, so far as I know, in European literature in the verses of the Athenian comic poet, Eubulus (fourth century B.C.), who complains of the affection lavished upon pet geese, sparrows, and monkeys.⁴ Greeks were lovers of pets. Monkeys are first mentioned in Archilochus (end of the eighth century B.C.), and in the fifth century—to judge from the references in the plays of Aristophanes, the comic poet—they were popular though still something of a rarity. In the *Acharnians* (produced 425 B.C.) a Boeotian is persuaded to barter goods for a maker of false accusations—a type of humanity which the poet represents as being common in Athens but rare in Thebes.

"By this an that an I might make me fortune
 By showing him for a mischievous ape"⁵

is the Boeotian's comment on his bargain. The Man of Petty Ambition whose character is sketched by

¹ Plutarch, *Life of Pericles*, 1.

² Catullus, i. 2 (Loeb Classical Library).

³ Ovid, *Amores*, ii. 6.

⁴ Eubulus, Frag. 115 in Kock, *Comicorum Atticorum Fragmenta*.

⁵ Aristophanes, *Acharnians*, 905 (trans. Tyrrell). Rogers's admirable translations of Aristophanes' plays are now being issued by G. Bell & Sons in an edition which contains the translation only. A bound copy of each play costs 3s. 6d.

Theophrastus¹ (372-278 B.C.) went in for pets of all kinds. He kept a monkey and a satyr ape, and "is apt also to buy a little ladder for his domestic jackdaw and to make a little brass shield wherewith the jackdaw shall hop upon the ladder. Or if his little Melitean dog has died, he will put up a little memorial stone with the inscription, 'A Scion of Melita.'"

"I would rather have a good friend," said Socrates, "than the best cock or quail in the world; I would even further say than a horse or dog."² The birds and animals referred to were primarily kept for purposes of sport; both cock-fighting and quail-fighting were favourite pastimes with the young bloods of the day. Alcibiades used to carry a favourite quail about with him. Plutarch tells a story of how, when he was distributing largesse among the people, "the multitude thereupon applauding him and shouting, he was so transported at it, that he forgot a quail which he had under his robe, and the bird being frightened with the noise, flew off; upon which the people made louder acclamations than before and many of them started up to pursue the bird; and one Antiochus, a pilot, caught it and restored it to him, for which he was ever after a favourite with Alcibiades."³

A pet bird was not an expensive luxury. In the latter half of the fifth century birds could be bought for pets or for the pot from Philocrates, the bird-seller, whose prices were 1 obol for a jackdaw and 3 obols for a crow.⁴ The fairest method of assessing prices is, of course, by their translation into contemporary wages or commodities. Two obols was the fee paid at this time to compensate a citizen for neglecting his business for a day in order to serve on a jury. Three obols at the end of the Peloponnesian War, when prices were rising, was the daily wage of a mason's assistant.⁵ One obol would buy a little toy cart⁶; extravagant persons might pay 20 drachmæ for a cloak and 8 drachmæ for a pair of sandals, but these were "Bond Street prices."⁷ A magical ring, an infallible protection against snake-bite, could be bought for 1 drachma, i.e. 6 obols.⁸

¹ Theophrastus, *Characters*, vii (trans. Jebb). In a volume called *English Literature and the Classics* (Oxford Press, 1912) there is a paper by G. S. Gordon upon Theophrastus and John Earle and his other English imitators, which is well worth the attention of anyone interested in literature.

² Plato, *Lysis*, 211 (trans. Jowett). Cf. Xenophon, *Memo- rabilia*, i, 6, 14 (trans. Dakyns). As I have pointed out elsewhere (*Liverpool Annals of Archaeology*, viii, 47), the coincidence between the two passages suggests that this is an authentic saying of Socrates'.

³ Plutarch, *Life of Alcibiades*, 10.

⁴ Aristophanes, *Birds*, 14, 18, 1077.

⁵ Idem, *Ecclesiazusæ*, 510.

⁶ Idem, *Clouds*, 861.

⁷ Idem, *Plutus*, 982.

⁸ Ibid., 884.

Sporting animals and the pets of the aristocracy ran into big prices. The hero of the *Clouds* of Aristophanes owed 12 minæ (1,200 drachmæ) for a race-horse,⁹ and Alcibiades paid as much as 70 minæ for a dog, whose long and beautiful tail he proceeded to cut off, a prank to make people talk about him.¹⁰ His extravagance may be measured by the price of slaves. At the sale of confiscated property belonging to Alcibiades and others, who were convicted in 414 B.C. of having blasphemously acted a parody of the sacred mysteries, the top prices for Syrian slaves were 2½ and 3 minæ, while Carian and Thracian slaves ran as low as 1½ minæ.¹¹

Of our two favourite domestic animals, the dog and cat, the cat proper which the Greeks called "wavy tail" (*ailouros*) was indigenous in Egypt, and it is represented in Aegean Bronze Age art in designs adapted from Egyptian originals; but Herodotus devotes some space to its description as a foreign animal,¹² and it does not seem to have been a usual inhabitant of Greek houses. The Boeotian in the *Acharnians* who has already been mentioned speaks of having cats to sell,¹³ but as a rule the marten cat (*galé*) seems to have been used in Greek houses to keep down the smaller rodents. The superstitious believed that it was bad luck if a *galé* crossed your path as you were going out.¹⁴ But the Greek lived in the market place and not at home; the mouser in consequence played little part in his life and hardly figures in literature.

With the dog it was otherwise. Plato used his virtues to illustrate the characteristics required by the warrior class in his ideal republic,¹⁵ but already in Homer we find him in his familiar aspects of the watchdog, the sporting dog, and the friend of man. Those who have travelled in modern Greece and have had to defend themselves with stones against the onset of the savage sheepdogs until their masters called them off will appreciate the truth of the picture of Odysseus's approach to the steading of Eumeus the swineherd: "And of a sudden the baying dogs saw Odysseus, and they ran at him yelping, but

⁹ Aristophanes, *Clouds*, 21.

¹⁰ Plutarch, *Life of Alcibiades*, 9.

¹¹ Hicks and Hill, *Greek Historical Inscriptions*, No. 72. No doubt Syrians were more highly educated and therefore more expensive. After Alexander's conquests black slaves became fashionable with people of social pretensions (Theophrastus, *Characters*, vii), as they were afterwards in Rome [Tibullus, II, iii, 55 (Loeb Classical Library)], and in England in the eighteenth century.

¹² Herodotus, ii, 66 (trans. Rawlinson). An amusing account of why Egypt is not overrun with cats. The historian notices also the mummied cats of Bubastis.

¹³ Aristophanes, *Acharnians*, 879.

¹⁴ Theophrastus, xvi, *The Superstitious Man*.

¹⁵ Plato, *Republic*, 375-6.

Odysseus in his weariness sat him down and let the staff fall from his hand. There by his own homestead would he have suffered foul hurt but the swineherd with quick feet hasted after them and sped through the outer door and let the skin fall from his hand. And the hounds he chid and drove them this way and that, with a shower of stones."¹ Telemachus walks into the market place at Ithaca with his two dogs at his heels.² Two of the nine "table dogs" which had belonged to Patroclus were slaughtered on his pyre to keep their dead master company.³ But the most famous passage is that describing the passing of the old sporting dog which Odysseus had left a puppy when he sailed for Troy. Old Argos ("Swift"), lying neglected on the dungheap, hears the voice of his master, who, returning after twenty years of wandering, remains unrecognised by human beings, even by his nearest and dearest. "There lay Argos, full of vermin. Yet even now when he was ware of Odysseus standing by, he wagged his tail and dropped both his ears, but nearer to his master he had not now the strength to draw. But Odysseus looked aside and wiped away a tear." He learns from Eumeus the story of the dog's neglect since his departure, and "therewith he passed within the fair lying house, and went straight to the hall, to the company of the proud wooers. But upon Argos came the fate of black death even in the hour that he beheld Odysseus again in the twentieth year."⁴

In historical times dogs were sacrificed at Sparta and in Caria to the god of war. In Thrace Herodotus reports the settlement of a dispute between Perinthus and the Paeonians by a triple duel in which the champions fought man to man, horse to horse, and dog to dog,⁵ and the people of Magnesia on the Maeander in Asia Minor are said to have trained dogs to fight with their heavy infantry.⁶ But in Greece proper dogs were not used in war, and the only example known to me is that of the dog who accompanied his Athenian master in the Battle of Marathon (490 B.C.), and was immortalised in the famous picture of that victory over the Persian invader with which Polygnotus decorated the Painted Colonnade at Athens.⁷

Sporting dogs were used in hunting the boar and coursing the hare. For the former Xenophon recommends Indian, Cretan, Locrian, and Spartan

¹ Homer, *Odyssey*, xiv. 29 (trans. Butcher and Lang).

² *Ibid.*, ii. 11.

³ Homer, *Iliad*, xxiii. 173 (trans. Lang, Leaf, and Myers).

⁴ *Idem*, *Odyssey*, xvii. 290 foll.

⁵ Herodotus, v. 1.

⁶ Pollux, v. 47.

⁷ Aelian, *Nat. An.*, vii. 38. I do not know of a modern English translation of this foolish but entertaining work. There is a Latin translation in the French Didot edition.

breeds.⁸ We may recall the famous description of an Elizabethan staghound pack which Shakespeare puts into the mouth of Theseus:

" My hounds are bred out of the Spartan kind,
So flewed, so sanded; and their heads are hung
With ears that sweep away the morning dew;
Crook kneed, and dew-lapped like Thessalian bulls;
Slow in pursuit, but matched in mouth like bells,
Each under each. A cry more tuneable
Was never holla'd to, nor cheered with horn
In Crete, in Sparta or in Thessaly."⁹

Dogs were used to protect private houses and were frequently attached to temples, which, apart from the valuables (plate, etc.) they contained, were also used as national banks. In the *Wasps* of Aristophanes the hero is obliged to keep his old father, who is in his second childhood, shut up to prevent him from indulging his passion for sitting in the law courts. The old man spends his time playing at law courts at home with the railing of the pig pen to make a court and the house dog, Labes ("Pincher"), to take the rôle of the accused.¹⁰ Of temple guardians the most remarkable were those of the sanctuary of the native Sicilian god, Adranus. During the day-time they made themselves pleasant to all passers-by. At night they showed singular discrimination. To thieves they gave no mercy, but if they met any friends of the god, who were temporarily incapacitated by conviviality, they led them safely to their homes, at the same time intimating their disapproval of such immoral conduct by tearing their clothes and rolling them in the mud without otherwise hurting them.¹¹

For lap-dogs the most favourite breed was the Melitean, affected, as we have seen, by the Man of Petty Ambition. They may have come originally from Malta, but perhaps more probably were native to the island of Meleda near Curzola in the Adriatic.¹² Little brown yapping creatures they seem to have been. Lucian gives a comic description of a Stoic philosopher named Thesmopolis, whose lady-love implores him to promise to do something for her. She wants him to take charge of sweet little Myrrine, who is not very well, poor darling, and the servants won't look after

⁸ Xenophon, *Cynegetica*, x. 1. The method of boar hunting was to track the quarry to its lair with a single hound; a Spartan bitch is recommended for this work. Cf. the mediæval tufting with a lime hound [Hamilton, *The Red Deer of Exmoor* (Field Office, 1907), 222 foll.]. Nets were spread round the covert and only then was the pack let go.

⁹ Shakespeare, *A Midsummer Night's Dream*, Act iv, Scene 1. Our ancestors, and indeed our immediate forbears, paid more attention to music and less to speed than modern breeders of foxhounds. On the whole subject see that delightful book, Madden, *The Diary of Master William Silence*.

¹⁰ Aristophanes, *Wasps*, 824 foll.

¹¹ Aelian, *Nat. An.*, xi. 20.

¹² The matter is discussed by Jebb in his notes on the passage in Theophrastus.

her properly. The unfortunate philosopher is compelled to make a fool of himself carrying the spoilt little Melitean dog, which peers, yapping, out of the fold of his cloak and keeps on licking his long beard.¹

In general the attitude of the ancient Greeks towards the dog was very much our own. Prototypes of most of the familiar dog stories are to be found in the collection of anecdotes about animals made by Ælian, including the dog story of Sir Walter Scott's *Talisman*, and that of the faithful animal which refuses to survive its master.² There is no trace in Greece of the Semitic view that the dog is an unclean animal.

In religion it is therefore unimportant. Sacrifices of dogs to the war god have been mentioned; at Argos there was an obscure sacrifice of dogs in connection with the feast of Linus, a hero connected with the fertility of flocks and herds. From some shrines dogs were excluded, probably on account of their uncleanly habits. That they were attached to temples for protection has been noticed. They were used in midnight magical offerings at the cross-roads to Hecate, the goddess of magic and the underworld, and their howling was considered a bad omen. They were also closely attached to the god of healing, Asclepius, and in some of the miraculous cures recorded in the dedicatory tablets at his great shrine at Epidaurus the healing was effected through the licking of the patient by one of Asclepius's dogs.³ That a dog's tongue has healing properties is a world-wide belief based upon observation of canine habits.⁴ *Langue de chien, sert de médecine*, runs a French proverb. Their association with the god of healing is therefore readily intelligible, but it is remarkable to find, upon the unimpeachable authority of an inscription confirmed by a fragment of a contemporary comic poet, that at the beginning of the fourth century B.C. the Athenians offered sacrifice to the sacred dogs at a shrine of Asclepius and to the "dog leaders," who are more probably spiritual agencies of some kind than human guardians of the dogs. So crude a superstition is unique in the ritual of the state religion of its time and place.⁵

¹ Lucian, *De Merced. Cond.*, 34. There is an excellent translation of this author by the brothers Fowler published by the Oxford Press.

² Ælian, op. cit., vii. 25, 40.

³ These are discussed in Frazer, *Pausanias*, iii. 249.

⁴ See Gaidoz, "A propos des chiens d'Epidaure," *Revue Archéologique*, 3rd series, iv. 217.

⁵ The matter has been discussed by Farnell, *Classical Quarterly*, xiv. 139 foll.

AMONGST other articles to appear in the July number of DISCOVERY will be the first instalment of a paper by Mr. Julian Huxley on *Sex and its Determination*; an account by Major W. T. Blake, the airman, who is participating in a round-the-world flight, of *The Progress of Aerial Photography*; and a narrative by Mr. Edward Liveing, compiled from various sources, of the fate of the poet Shelley, the centenary of which falls on July 8.

Fertility Rites in Modern Egypt

Winifred S. Blackman

Oxford Research Student in Anthropology

RITES to ensure the birth of children are practically world-wide and they are of great variety. The failure of offspring involved the weakening of the tribe, which in early times was dependent on its numerical strength for its defence against hostile neighbours. Hence the importance of the possession of children, especially those of the male sex.

Love for their children is a marked trait in the character of the modern Egyptians. I have heard it asserted that an Egyptian man is seen at his best when among children, and my own observations have so far certainly borne out this statement. While visiting various villages in Upper Egypt, I have frequently attended to inflammation of the eyes and other lesser ailments of the inhabitants. On these occasions men, almost as often as women, have brought their children for me to see, with a view to asking my advice as to their health, and I have been struck by the gentle way in which they treated their little ones.

Under Muslim law a man may divorce his wife if she bears him no children. A woman divorced for this reason has but a small chance of obtaining another husband; hence the prospect of childlessness is a very real terror to her. The methods resorted to in order to prevent such a catastrophe are numerous.

Some years ago when I was working at a large collection of charms and various magical appliances at the Pitt-Rivers Museum in Oxford, it occurred to me that some so-called "pendants," which my brother had brought from Egypt and given to me, might have some "magical powers" attached to them. These "pendants" are modern copies of ancient Egyptian blue-glazed amulets, representing gods, goddesses, sacred animals or scarabs. I showed these objects to the Egyptian Sheikh then resident in Oxford and asked him what they were used for. After some hesitation he told me that they were women's charms and were used in Upper Egypt⁶ as a means for producing children. He also told me that, in the event of a man travelling about that part of Egypt with these charms, the women would flock out of the villages to meet him in order that they might "jump" over them.

Soon after my arrival at Gebel Meir in Asyūt Province in the winter of 1920-21, a certain number of childless women sent appealing messages to me asking me if I could let them have a bone out of the large

⁶ As a result of my personal researches in Egypt I have found that these charms are used very generally all over the country.

numbers, which had been dug up during the recent excavations of Seyd bey Khashbeh and lay scattered about the ancient burial site on which our camp was situated. Their object was to "jump" over the bone in order to ensure the production of offspring. I acceded to their request and then, of course, thought of my "pendants," which unfortunately I had forgotten to bring out to Egypt with me. However, I sent a message to the women to say that I had written to England, requesting that certain very potent charms that I possessed should be sent to me as soon as possible.

When the parcel arrived, I caused the fact to be known in the various villages of the district, at the same time intimating that I should be glad to see any of the women who wished to make use of them. From that time onwards, in order to take advantage of my offer, women, sometimes as many as ten at a time, would walk from their various villages across the lower desert up to our camp on the hills which rose into the upper desert. They were usually accompanied by a middle-aged man or woman, sometimes by both. The man was not present at the ceremony, but the woman chaperon stayed with them all the time.

The ritual was as follows: The women first repaired



FIG. 1.—A WOMAN IN THE ACT OF STEPPING OVER TWO OF THE BLUE-GLAZED AMULETS, OUTSIDE THE ROCK-CUT TOMB-CHAPEL, WHERE THE AUTHOR LIVED.

to one of the ancient decorated tomb-chapels, accompanied by our servant, who had the key, and on entering them, one by one, stepped seven times backwards and forwards over what they supposed to be the

mouth of the shaft admitting to the subterranean burial chamber. When all had thus performed, they returned to the undecorated tomb-chapel in which I

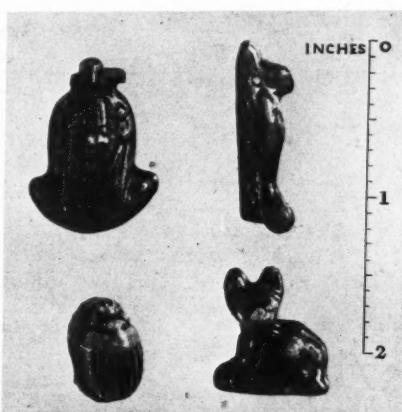


FIG. 2.—THE BLUE-GLAZED AMULETS.

lived. Here I produced the charms, two of which were placed on the ground at a time, and then were solemnly stepped over seven times, backwards and forwards, by each woman (Fig. 1). Four charms in all were used, representing the head of Isis, a mummiform divinity, a scarab, and a cat (Fig. 2). When this was accomplished, a lower jaw-bone of an ancient Egyptian was placed on the ground and a similar ceremony was gone through, this ceremony being also repeated in the case of two heads of the ancient inhabitants, one a well-preserved mummified head, the other a skull. A glass of water was then brought, into which the blue-glazed charms were dropped. Each woman drank some of the water, and then picked out the charms and sucked them. Some of the women also rubbed their bodies with these magical objects. Generally, especially when, as was often the case, I took my charms to women in the villages, each woman would have a separate tumbler of water into which the charms were placed, and, after drinking some of the water, sucking the charms, and sometimes rubbing herself with them, she took the remainder of the water and doused herself with it.

It may interest my readers to know that on my return to Egypt at the end of last year one of the first items of news communicated to me by my servant was that at least two of the women who had "jumped" over my charms and the ancient heads and jaw-bone would shortly present their husbands with a child.

I am told that great efficacy is attached to the pyramids, and that a childless woman will repair to one of them and walk round it seven times, believing that this will enable her to become a mother. Women sometimes beg to be allowed to remove small portions

of the decorated walls in ancient tomb-chapels as charms to ensure their bearing children. It appears that ancient things in Egypt are credited with great potency in this respect. It is difficult, if not impossible,



FIG. 3.—THE STONE WITH ITS "SERVANT" AT KUSIYEH.

to obtain any reliable information from the people themselves as to why they attach so much magic to antiquities. Originally there may have been some belief in reincarnation—the stepping over the tomb-shaft and the bones suggest this—but there is also the idea that *baraka* is attached to anything that is old or sacred, or even peculiar. The word *baraka* means "blessing," and *baraka* is "a lucky coin," "a thing to bring good luck." This quality is often attributed to the tombs of Sheikhs, and such buildings are consequently visited by people who have some special request to make, hoping in this way to obtain a "blessing" or "good luck."

Women who have no children will sometimes visit a Sheikh's tomb entreating him to intervene on their behalf and vowing to make some return if their wish is granted. A cord or cords are often to be seen hanging across the inside of such a building, and from it are suspended a variety of objects, including coloured handkerchiefs. These are in many cases the votive offerings of women, which they have hung up in the tomb when their prayers for offspring have been answered.

Lane¹ records the practice of visiting tombs or

¹ *Manners and Customs of the Modern Egyptians*. London, 1895, pp. 246 ff. A cheap edition has been published in "The Everyman's Library"; see same page therein.

mosques to obtain a blessing, or to urge some special petition, such as the gift of children. He states that the suppliants believe that a more favourable reception of their prayers will be granted them if offered up in such sacred places.

It has been recorded by Mrs. Haris H. Spoer,² that in Jerusalem childless couples will travel for considerable distances in order to visit and bathe in certain pools, and that "barren women visit the hot springs in various districts, not, as might be supposed, for any medicinal properties, but because the *jinni*, who causes the vapour, is regarded as a being capable, in a definite and physical sense, of giving them offspring." She adds, "Belief that women may have intercourse with disembodied spirits is common among Muslims"; and I have also found the same belief existing among the peasants of the Fayūm.

Baraka is also occasionally believed to be possessed by, or attached to, living people. Over and over again women have come up to touch me because they believed I had this virtue. Babies were handed to me to hold in my arms for the same reason. As I generally manage to hush a squalling infant to sleep, their belief in me was strengthened, and they would say, "Ah, it is true; she has got *baraka*!"

It is a popular belief in Egypt that if a dead child is tightly bound in its shroud the mother cannot conceive again. Therefore the shroud is always loosened just before burial, dust also being put in the child's lap. If, in spite of the precautions, the woman, as time goes on, seems to have no prospect of again becoming a mother, she will go to the tomb of her dead child, taking with her a friend, who opens the tomb. The disconsolate mother then goes down to the place where the body lies and steps over it backwards and forwards seven times.

A somewhat similar practice has been noticed among the Bangalas, a tribe who live in Equatorial Africa, to the north of the Congo. On one occasion a woman of this tribe was seen to be digging a hole in a public road. Her husband explained to a Belgian officer who was present that his wife wished to become a mother, and begged that she might be left unmolested, promising on his part to mend the road afterwards. The woman continued to dig till she had unearthed the skeleton of her dead child, which she affectionately embraced, begging it, at the same time, to enter her body to be reborn.³

The last-mentioned Egyptian practice, viz. that of stepping over the dead child, is distinctly suggestive of a belief in reincarnation. Such a belief is indeed definitely averred in the account given of the strikingly

² *Folklore*, xviii, 1907, p. 55, "Powers of Evil in Jerusalem."

³ Quoted by Sir J. G. Frazer, *The Golden Bough*, "Adonis, Attis, Osiris," vol. i, p. 92.

similar practice from the Congo region, the mother, as we have seen, expressly requesting the spirit of her dead child to enter her in order to be reborn. Possibly in Egypt the people may have no concrete ideas on this point. The custom may have had its origin in an early and definite belief in rebirth, the ceremony being continued at the present day because it has become the custom and is one of the recognised devices resorted to as a cure for barrenness, while the belief which gave it birth no longer consciously exists in the minds of the people who practise the rite.

There is a belief in the Fayūm Province, and it may prevail in other parts of Egypt, that if a woman who has lately become a mother goes to see another woman who has recently given birth to a child which has died, the latter will not conceive again. Such a visit should not be paid till the child has been dead for fifteen days. Should such a meeting take place accidentally, the mother of the dead child must counteract this evil influence by visiting the child's tomb as described above.

Sometimes, if a woman has no children, her friends will take her to the railway and make her lie down between the lines in order that the train may pass over her. Again, a friend will bring a large lizard of the kind called *waran* for a childless woman to step over three, five or seven times. Yet again, the pollen of the male palm is mixed in water, which is then given to a childless woman to drink. All these are effective methods, it is believed, of inducing conception.

Particular stones, either those covering the body of a dead Sheikh, or those of large size or peculiar shape, are also visited by childless women. There is a stone in the centre of a field, just outside the village of El-Habalsá in Asyūt Province, which is frequented by the women for various reasons, one of them being for the purpose of securing offspring. The stone, which is roughly conical in shape and is of small size, is surrounded by whatever crops are being cultivated on that spot. It has been thus utilised by the women for a long time, one hundred years I was told, though this may be only a way of expressing a lengthy period. Men have often tried to dig it up, excavating to a considerable depth all round it, but they have never come to the bottom of the stone, according to my informant.¹ A certain mystery is attached to the stone because of this belief, thereby doubtless enhancing its magical value.

There is another very large stone at Kuṣiyeh, a town in the near neighbourhood of El-Habalsá. It stands in a field situated between two large burial grounds. Childless women are in the habit of visiting the stone and either walking round it or stepping over it seven

times to enable them to have children. There is a woman called "the servant" of the stone who attends on such occasions and receives donations from the visitors (Fig. 3).

Just outside Dalga, a large village in Asyūt Province



FIG. 4.—STONES COVERING THE BURIAL-PLACE OF THE SHEIKH ABDU'R-RAHMĀN AT DALGA.

and lying close to the edge of the desert, is an erection of stones which covers the burial place of the Sheikh Abdu'r-Rahmān (Fig. 4). A domed tomb formerly stood there, but it gradually fell into disrepair and in course of time nothing was left of it. The stones are placed over the spot where the body lies, in order to prevent passers-by from treading over the dead man. These stones are visited by childless women who walk round them seven times in the belief that by so doing their barrenness will be cured.

The water with which a corpse is to be washed is, if possible, obtained from a mosque. After the washing is completed a barren woman will "jump" over the water, i.e. step over it backwards and forwards, seven times. My informant² told me that he saw this done on one occasion, and the woman conceived a month afterwards.³

In all the cases mentioned above I have not found anything quite comparable with the belief, which many anthropologists assert is held by various primitive peoples, notably certain tribes in Australia, that the father has nothing to do with the genesis of the child;

² Hideyb 'Abd-esh-Shāfi of Illāhūn, Fayūm.

³ Cf. E. W. Lane, *Modern Egyptians*, London, 1895, pp. 266-7.

¹ Ibrahim Effendi Narūz, schoolmaster at Meir, to whom I am indebted for a good deal of valuable information on this subject.

indeed, in some instances, his co-operation was definitely alluded to as essential to it. On the other hand, I have quite recently come across certain ideas, current among the peasants of the Fayūm, which do point to a certain amount of ignorance in this respect, though not associated with the rites described in this paper.

Imperial Wireless Communications

By Lt.-Col. C. G. Crawley, R.M.A., M.I.E.E.

FOR several months past there has been an uninterrupted flow of articles, leaders, and letters in the Press on the subject of Imperial wireless communications, and the matter as a whole has become so obscured in clouds of controversial detail that it may be of interest now to take stock of realities, past and present, and hopes for a future.

Imperial wireless may be said to date from October 1900, when the Marconi Company started the erection of the first high-power station in the world, at Poldhu in Cornwall. Unfortunately the first check in the long list which has followed came within a year when the masts at Poldhu were wrecked by heavy gales in the autumn of 1901. The year 1902 was spent in making good this loss, and in further improvements, and on December 18 Mr. Marconi opened up a fresh page of history by sending a wireless message from the Cape Breton Station in Nova Scotia to King Edward VII in England. The following year, 1903, saw the institution of a regular wireless service to ships at sea, and in 1904 the first Imperial service was working, though far indeed from regularly, between this country and Canada. In 1905 the Marconi Company started the erection of a high-power station at Clifden on the west coast of Ireland, and in 1907 a commercial transatlantic service was opened between this station and Glace Bay in Nova Scotia.

It had thus taken seven years of unflagging hard work and resourcefulness, in face of what then seemed to many quite insurmountable obstacles, for Mr. Marconi and his small band of enthusiastic followers to forge the first link in our Imperial wireless communications.

During the next four years, on the practical side, the Clifden-Glace Bay service went on improving (but at a rate which gave no sleepless nights to shareholders in cable companies); and on the theoretical side, the idea of an Imperial system progressed equally slowly, until it culminated eventually in a decision at the

Imperial Conference of 1911 to the effect that an Imperial wireless chain of stations should be erected without delay. In July 1912 the Postmaster-General entered into a contract with the Marconi Company for the erection of the chain. By this contract the Company were to erect stations in England, Egypt, East Africa, South Africa, India, Singapore, and Hong-Kong, the chain being extended from Singapore to Australia by the erection of a station by the Australian Government at Port Darwin. This was the scheme which gave rise to the bitter discussions which led to a Parliamentary Committee of Inquiry in the following year. A commencement was made with the construction of the English station at Leafield near Oxford, and of the Egyptian one at Abu Zabal near Cairo, but the outbreak of war in 1914 resulted in a change of policy, and this scheme of Imperial wireless intercommunication was dropped for a less grandiose one of Imperial wireless ship and shore communication. This latter scheme consisted of the erection of medium-power stations, primarily for ship work, at Jamaica, Bermuda, St. Johns (Newfoundland), Demerara, Aden, Mauritius, Durban, Port Nolloth, Bathurst (Gambia), Seychelles, Colombo, Singapore, Hong-Kong, as well as more powerful ones at Ascension and Falkland Islands. Jamaica and Bermuda stations were erected by the Admiralty, and the remainder on behalf of the Admiralty by the Marconi Company. These stations, along with a similar one erected by the Admiralty in the Azores (Portuguese territory), proved of great value during the war for the purpose for which they were designed, viz. communications with ships and occasional point to point strategic communications, but they were not powerful enough, nor could they be adapted for commercial working as an Imperial chain.

As soon as the war was over, and the Marconi Company had been awarded in the law courts over half a million pounds sterling as compensation from the Government for the abandonment of the larger scheme, the desirability of pushing on with some such scheme again became apparent, especially as the cables were much congested, and the consequent delays were seriously hampering the reorganisation of business throughout the Empire. In 1919 the Government decided to go on at once with the erection by the Post Office of the stations near Oxford and Cairo, and to appoint a Committee to go into the whole question of Imperial wireless communications. The Oxford station was opened last August, and has been used for various long-distance communications; the Cairo one has just been completed, and the Oxford-Cairo service is now in operation.

The Committee appointed by the Government, the Imperial Wireless Telegraphy Committee, under the

an
ected
eral
for
com-
East
ong-
to
lian
ame
to
ing
on-
Ox-
ear
n a
less
ose
on.
um-
rica,
ura,
urst
ng,
alk-
ere
on
ny.
the
ved
ich
ips
ns,
ey
ial
oni
ver
om
ger
me
he
ys
ess
nt
ost
to
of
on
us
as
is
ne

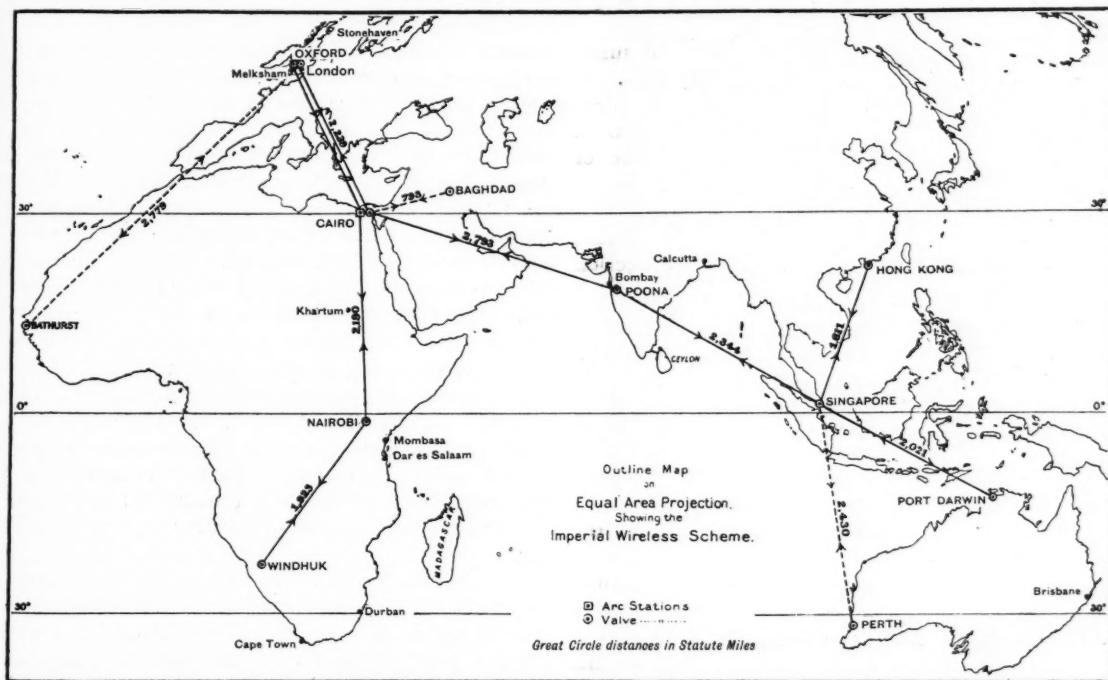
chairmanship of Sir Henry Norman, M.P., consisted of three independent wireless experts and four Government officials closely connected with the development of wireless and electrical science generally. This Committee's report, dated June 1920, was approved by the Government and by the Imperial Conference of last year, Australia, however, retaining full freedom of action as to the method in which she would co-operate.

The Committee's recommendations included :

(1) A chain to South Africa consisting of the present stations at Oxford and Cairo, a new station near Nairobi in Kenya Colony, and the ex-German station at Windhuk, South Africa (to be altered as necessary).

The Committee's report has given rise to criticism on two points: first, that the State is to erect and work the stations; secondly, that instead of having direct working between England, India, South Africa, and Australia, the scheme contemplates the use of intermediate stations.

As regards erection and ownership by the State, it has been urged that the chain could be erected more rapidly and worked more efficiently by private enterprise than by Government, and the success of such an arrangement in the case of our cable communications has often been referred to in this connection. The Committee, however, pointed out that an Imperial wireless system to work efficiently must be protected



Reproduced from the Report of Wireless Telegraphy Commission.

(2) A chain to Australia consisting of new stations in England, Egypt, Singapore, and Australia, with a branch to Hong-Kong from Singapore.

(3) A third station in England to communicate with Canada.

(4) The stations to be planned by a Wireless Commission of about four members, the constructional work being entrusted to the Post Office and the corresponding Dominion and Indian Authorities.

The Committee estimated that the total capital cost of the scheme, excluding the Canadian link and the existing Oxford-Cairo link, would be £1,243,000, of which £853,000 would fall on the Imperial Government.

from interference from other sources owing to the very limited number of "wave-lengths" available for long-distance working, and of these "wave-lengths," in any international agreement, only a proportion could be claimed for the British Empire. In other words, the Committee claimed that owing to the mutual interference which is so easily caused by the signalling of high-power wireless stations, any Imperial scheme must be, for all practical purposes, a monopoly, and though there might be objections to a Government monopoly, there were greater objections to a private monopoly. In the case of cables this monopoly question does not, of course, arise, as there is no mutual interference, and, therefore, no limit technically to the

number of competing cables that may be used for any one connection.

As regards the superiority of direct working between the main centres as opposed to utilising intermediate stations for passing on the messages, there can be no question. But the point is, whether stations can at present be erected in England, India, South Africa, and Australia to give economical direct working at all times. The Committee thought not, and proposed the use of intermediate stations.

Australia, however, has decided to erect a station which will obtain for the Commonwealth direct communication with the United Kingdom, and similar schemes for India and South Africa have been the subject of frequent communications to the Press.

The Commission for planning the Government stations was appointed in December 1920, and in their report published in January last it was made clear that they were in agreement with the views of the Norman Committee. The stations (shown on the map which illustrates this article) which they have planned for the main centres will be capable of direct working with one another, except during periods of unfavourable atmospheric conditions, when use will be made of the intermediate stations. For what average periods of the day and night this direct working will be practicable it is impossible to predict, more than to say that direct working between centres will be possible for several hours daily on the average, and that with the help of the intermediate stations an efficient commercial service will be available at all times.

believed, in being digested pass through a stage of lactic acid ; in other words a sour stage.

The exact physiological condition in starvation could not be put better than in the line in *Coriolanus* (Act IV, Sc. 2) :

"I sup upon myself, and so shall starve with feeding."

In inanition the body lives on itself, as it is said ; what is actually happening is that the heart and central nervous system are living on the fat and muscles of the body. The former two—the noble tissues—are living at the expense of the rest of the body ; it is, therefore, physiologically correct to say that in starvation there is feeding.

No less interesting than Shakespeare's allusions to the vascular system are those to the nervous. In his day, unlike ours, all emotional conditions were not at once referred to the cerebrum and so disposed of ; there was a complicated distribution of them amongst the various viscera. Even much later than Shakespeare's time the seat of the soul was held to be in the heart ; for instance, by Vico (1678-1774). Descartes assigned it to the pineal gland ; Van Helmont placed it in the pylorus or "pit" of the stomach. Although Aristotle said the soul was in the heart, other Greek thinkers placed it in the diaphragm (phrēn) ; hence "phrensy" (frenzy), or madness of the soul ; hence also "phrenology," a discourse on the supposed localisation of things mental. From time immemorial emotions have been associated with viscera, as in the Old Testament, where bowels yearned, and in the New, where there were bowels of compassion. Everybody knows that the spleen was supposed to be the seat of anger ; and we yet speak of a splenetic, meaning an angry, man, and a "fit of the spleen," meaning one of rage.

Curiously enough, love was placed not in the heart but in the liver. Shakespeare adopts this localisation when he makes Pistol in the *Merry Wives* (Act II, Sc. 1) say that Falstaff loves Ford's wife "with liver burning hot."

We have seen that, whereas Aristotle placed the soul in the heart, Galen placed it in the brain ; and Shakespeare, if he consciously followed any school of thought, was Galenical rather than Aristotelean, for he makes Prince Henry in *King John* say of the King :

"It is too late, the life of all his blood
Is touched corruptibly, and his pure brain
(Which some suppose the soul's frail dwelling place)"—

etc., as though it were not yet decided, although some supposed the soul to be in the brain.

Shakespeare certainly recognised the brain as the organ of consciousness or states of mind. This was by no means the commonly accepted doctrine in his time.

Biology in Shakespeare

II.

By D. Fraser Harris, M.D., D.Sc.

Professor of Physiology at Dalhousie University, Halifax, N.S.

(Continued from the May No., p. 134)

BEFORE passing on to Shakespeare's allusions to the nervous system and to psychological considerations, we might notice some phrases which refer to subjects of distinct physiological interest. For instance, when it is said in *Richard II* (Act I, Sc. 3)—

"Things sweet to taste prove in digestion sour"—

we have a remark in agreement with the latest results of physiological chemistry. The sugars, it is now

The Queen in *Hamlet* (Act III, Sc. 4) says, as the Ghost disappears—

“ This is the very coinage of your brain ;
This bodiless creation ecstasy
Is very cunning in.”

In modern language this is a visual hallucination.

The hackneyed words of Cassio in *Othello*, “ O that men should put an enemy in their mouths to steal away their brains,” is one more Shakespearean recognition of the brain as the seat of the reason.

In *Anthony and Cleopatra* there is another remarkable passage apropos of this subject, where Anthony says (Act IV, Sc. 8) :

“ Yet have we a brain that nourishes our nerves.”

We dare not read into this line all that is involved in our modern doctrine of the nerve-cells in the brain being the highest trophic realm for the nerve-cells lower down which in turn give rise to the nerves themselves. If, however, it does not mean this, it does not seem to mean anything: it appears to embody some profound truth.

Possibly one of the most remarkable of all the passages of biological significance in Shakespeare is in *Love's Labour's Lost*, where Holofernes, speaking of ideas, says :

“ These are begot in the ventricle of memory, nourished in the womb of pia mater, and delivered upon the mellowing of occasion.”

Holofernes is a schoolmaster, and therefore presumably represents a learned man, and certainly here his allusions are sufficiently erudite to puzzle a good many fairly well educated people.

The “ ventricle of memory ” is a phrase borrowed from the Arabian doctors of medicine, who held that the brain possessed three cavities or ventricles in which the three subdivisions of the chief soul resided. The anterior was related to sensations, the middle to imagination, the posterior to memory. (Modern anatomists describe five cerebral ventricles.) These views were adopted by the theological Doctors of the Church in the Middle Ages. They were one of the beliefs against which Andreas Vesalius, the father of anatomy, particularly inveighed in his celebrated treatise, *De Corporis Humani Fabrica*, published in 1543. In dealing with the brain he wrote: “ I wonder at what I read in the scholastic theologians and the lay philosophers concerning the three ventricles with which they say the brain is supplied.” “ He then,” says Sir Michael Foster, “ goes on to ridicule the views held by these philosophers, namely, that a front ventricle is the receptacle of sensations which, passed on to a second ventricle in the middle of the head, are there used for

imagination, reasoning and thought, and that a third ventricle near the back of the head is devoted to memory.” Shakespeare adopts the unscientific terminology of the pre-Renaissance writers in the matter of mental states related to cerebral ventricles.

The expression “ nourished in the womb of pia mater ” is certainly obscure. “ Pia mater ” is the name given by anatomists to the highly vascular, soft membrane which, closely investing the brain and central nervous system, conveys to it the nourishing blood-vessels. It does in a sense nourish the brain, and, therefore, metaphorically might be said to bring to development anything functionally related to the activity of the brain. Whether or not Shakespeare knew of the anatomy of this membrane it is impossible to determine; but assuming that ideas are “ begot ” in a cerebral ventricle, it would be permissible to continue the simile and regard them as nourished by the membrane that nourishes the organ of thought. The completion of the analogy between giving birth to a child and bringing forth a thought is, of course, thus made possible. The passage is very striking, and shows Shakespeare familiar at least with the anatomical terminology of his day.

The allusions in Shakespeare's writings to the activities, both normal and morbid, of the central nervous system are quite as interesting as those relating to the heart and blood-vessels. The symptom of giddiness is mentioned several times in the plays.

In *King John* (Act IV, Sc. 2), for instance, we have the line—

“ Thou hast made me giddy with these ill tidings.”

Sudden violent emotion is very liable to produce giddiness; but few persons except those trained in physiology could explain exactly how this is so. The emotion, usually of an unpleasant kind, arises on its physical side as an excitement of certain cells of the cortex cerebri; these cells discharge impulses to the nerves of the heart which have the effect of making the heart-beats ineffective (inhibiting them) for driving enough blood to the brain and central nervous system. The result of this is a general lowering of blood-pressure, so that the cells of the central nervous system, whose duty it is to innervate the muscles engaged in balancing the body, do not now get sufficient blood. The body, therefore, sways and tends to fall, and the subjective sensation accompanying this disturbance of equilibrium is a feeling of giddiness. Cerebral anaemia, in short, produces giddiness. It also produces loss of function in the cerebral sensory centres, and chiefly in the centre for vision, so that the person affected suffers from imperfect sight. This is interestingly noted in *Henry IV* (Part II, Act IV, Sc. 4), where King Henry says :

“ And now my sight fails and my brain is giddy”—

Shakespeare correctly attributing the giddiness to the organ involved. Shakespeare has not failed to note the subjective sensations which a giddy person experiences when stable, external objects seem to be moving round him and particularly in the direction opposite to that towards which he last moved. Thus we have in *The Taming of the Shrew* (Act V, Sc. 2)—

“ He that is giddy thinks the world turns round.”

Hamlet (Act III, Sc. 4) makes a remark in reference to the functional activities of the nervous system of so profound a character that we hesitate to believe that Shakespeare really knew all it involves :

“ Sense, sure, you have,
Else you could not have motion.”

The principle that sensory impressions must precede motor in the education of the nervous system is now regarded as of immense practical importance. It is a fact which, of course, could not have been known to Shakespeare that those tracts in the central nervous system which subserve sensation are developed functionally a considerable time before those which subserve movement. Shakespeare's marvellous observation had, however, shown him the truth of this important generalisation without the possibility of his having had any acquaintance with the physiological bases for it.

As one would be prepared to believe, the more exclusively the topic has to do with the human mind, the more penetrating is Shakespeare's treatment of it.

The oftenest quoted example of this is the psychic blindness of Lady Macbeth :

“ Doctor : You see her eyes are open.
Gentlewoman : Ay, but their sense is shut.”

That the eyes are open is not enough to ensure vision unless the centre for vision in the brain is also in activity is the physiology underlying this passage.

It is a state of mind-blindness, the result of extreme abstraction of the attention, a condition analogous to the state of the brain in hypnotism where a person can by suggestion be made blind although his eyes are open. Lady Macbeth is described as “ fast asleep ” but with open eyes. This is not natural sleep, for in it the eyelids are always closed. Shakespeare correctly describes a condition popularly called “ trance,” in which, although the eyes may be open, there is no vision in the unconscious brain behind them.

Shakespeare clearly believed the brain to be the organ of the formation of images or ideas. One more example of this may be given from the *Merry Wives* (Act IV, Sc. 2) :

“ Ford : Well, he's not here I seek for.
Page : No, nor nowhere else, but in your brain.”

Coloured after-images or, as some call them, the results of retinal fatigue, are also alluded to in one of the plays. In *The Taming of the Shrew* (Act IV, Sc. 5) Katherine says :

“ Pardon, old father, my mistaking eyes
That have been so bedazzled with the sun
That everything I look on seemeth green.”

This is a literal experience known to many : if the eyes are over-stimulated by exceedingly bright sunlight and one goes indoors suddenly, everything takes on a rather ghastly greenish hue.

A very striking passage involving biological interest we may take from *Hamlet* (Act I, Sc. 5), where the Ghost remarks :

“ The glow-worm shows the matin to be near,
And 'gins to pale his uneffectual fire.”

A minor point of interest is in connection with the paling of the light because of the dawn. The light of the glow-worm, in common with all lights, would begin to appear paler as the morning daylight increased. More technically, the light of the glow-worm is relatively feeble owing to the stimulation of the retina by a much intenser light. It is the same phenomenon as the extreme paleness of the moon's light when seen during the day. But there is a much more interesting word in this passage—the word “ uneffectual ” as applied to the “ fire ” or light of the worm. Surely Shakespeare means to convey the notion that the “ fire ” of the glow-worm is uneffectual because it is unaccompanied by heat. Now the fact has been established only quite recently that, when organisms emit light by an oxidative process known as chemiluminescence, the chemical energy is used directly for conversion to light-energy without passing through the stage of heat. In this sense, then, the light of the glow-worm is an uneffectual fire, because, being accompanied by no heat, it could set fire to nothing. Fire that will not set fire to anything is indeed uneffectual.

It need hardly be pointed out that it is only Nature that has succeeded in producing light without heat. Man has never yet achieved what he so greatly desires, a source of light without an accompanying very high temperature, for the heat generated along with light is wasted energy as far as illuminating purposes are concerned. The spectrum of animal light shows it to be devoid of vibrations both towards the red and the violet end of the spectrum ; it is, therefore, chemically (photographically) inert, which is another aspect of its ineffectiveness.

But this is not the only Shakespearean allusion to the glow-worm, for Pericles says (Act II, Sc. 3) :

“ Where now his son's like a glow-worm in the night,
The which hath fire in darkness, none in light.”

The principle in the physiology of the senses alluded to here is the well-known one of the inability of the retina to perceive so feeble a light as that, for instance, of a star in broad daylight. Hence, too, the light of the fire viewed in sunlight makes so feeble a visual impression that the popular belief is that the fire actually goes out on account of the sunlight. The explanation of the invisibility or feebleness of lesser lights in presence of greater is that the retina, already being fully stimulated, is not able to yield any additional response. As it is already doing so much, it is, relatively to any additional stimulus, in the state known as functional inertia.

One more fact in the physiology of the eye is illustrated in the same play when Achilles says :

"Eye to eye opposed
Salutes each other with each other's form."

This probably alludes to the seeing of oneself reflected in the eye of another. The images so produced are known in physiology as the Purkinje-Sanson images : the cornea of each eye acts as a convex mirror for the other person.

Let us close with three allusions of much interest to surgeons.

It is well known to surgeons that a broken bone healed by the callus which grows between the two ends at the fracture is much stronger than it was before. This is alluded to in *Henry IV* (Part II, Act IV, Sc. 1), where the Archbishop of York says :

"If we do not make our atonement well,
Our peace will, like a broken limb united,
Grow stronger for the breaking."

The lines from *Othello* (Act II, Sc. 3)—

"How poor is he that hath not patience,
What wound did ever heal but by degrees"—

show that the chief characteristic of a healthy healing wound had been appreciated by Iago.

The lines in Hamlet's speech (Act III, Sc. 4)—

"(Mother, for love of grace,
Lay not that flattering unction to your soul,
That not your trespass, but my madness speaks),
It will but skin and film the ulcerous place,
Whiles rank corruption, mining all within,
Infects unseen"—

could hardly describe better the condition of a certain kind of wound, troublesome to the surgeon at all times, but particularly to-day when nothing is allowed to remain septic.

Reviews of Books

A NEW ACCOUNT OF THE PALÆOLITHIC PERIOD

A Text-book of European Archaeology. By PROF. R. A. S. MACALISTER, Litt.D., F.S.A. Vol. i. : "The Palæolithic Period." (Cambridge University Press, 50s.)

Professor Macalister has written one of the best books on Archaeology in any language. No one could possess better qualifications for the task he has set himself and in part accomplished. He is a Scotchman, whose practical experience was gained in Palestine, and who now lives in Ireland ; and he combines brilliant imagination with sound judgment.

The first volume consists of 610 pages, 184 illustrations, and a good index. The first chapter is introductory ; the next two deal with geology and palæontology, so far as these concern the student of human evolution. Chapter IV is an admirable and most readable summary of the methods of his science. The next four deal with the palæolithic period. Chapter IX is called "The Psychology of Palæolithic Man." Chapter X concludes the descriptive part of the volume with an account of the Mesolithic Period—that shadowy border-line between the Old and the New. The last chapter is a summary of "The Palæolithic Period as a Whole." In some ways the first four chapters are the best in the book ; they certainly make the best reading, for in writing them the author has been able to give free rein to his literary powers. They have obviously been written with enjoyment ; that is doubtless the secret of their success, for there is no pleasure in reading what has obviously been written only from a sense of duty. They reveal the author as an original thinker, whose point of view is essentially sane, but not always orthodox ; and as one who has little use for the mere collector, the "tea-party" archaeologist, or the crank.

The author passes his many tests with flying colours. One of these is that of the Galley Hill skeleton—a "victim," as he says, "of the eager competition of collectors." To base important conclusions on a skeleton whose "gisement" was imperfectly observed is unscientific ; and Professor Macalister is rightly sceptical as to the great age attributed to it by some authorities. This discovery, made in 1888, is a crucial instance of the principle that in archaeology it is not *what* is found that is of value, but *how and where* it is found—in what kind of soil, disturbed or undisturbed, and so on.

It would be tedious in a review to follow our author down the chilly corridors of the Ice Age, though his account of them is fresh and stimulating. The earlier part of the Palæolithic Period—from the Chellean to the Mousterian—seems to have been rather a "dull" time in human history. At any rate we confess to finding the latter part more attractive—the cave paintings, the fine flint craftsmanship, and the men themselves who mark the dawn of a new epoch. Still more fascinating is that earliest glimpse of modern times, which reveals new races beginning to arrive from the mysterious east, bring-

ing with them new arts, new customs, and, doubtless, a new religion. We may be sure that the domestication of animals was one of these, and it is in his imaginative description of the process that Professor Macalister stands out as first and foremost a prehistorian who has had the opportunity of living amongst primitive peoples and profited by the experience. "The beginnings of the domestication of animals," he says (p. 520), "were probably quite simple and commonplace. To some extent I have seen the process re-enacted for myself, when encamped in the Judæan wilderness. Some wretched starving half-jackal cur creeps stealthily up to the refuse heap and roots for bones, watching warily the while for the expected stone. The master of the encampment is, however, for the moment in a good humour. He has for once dined well, and in a fit of idle joviality he throws, not a stone, but another bone, to the visitor. The grateful beast, which has sprung aside with an anticipatory yelp, is taken by surprise at the unexpected favour, and creeps a little closer into the confidence of the encampment. At night, some thief or enemy comes to surprise the camp, and the dog rouses the sleepers in time to defend themselves. Thus the use of a watch dog is discovered, and the animal becomes permanently attached to the settlement. After a time he begins to accompany the man who is now his master on hunting expeditions, and there proves himself of further use."

The book has two unfortunate lapses—the maps on pp. 263 and 277. Many of the places are in the wrong position and the rivers are very inaccurately drawn. The Blackwater, for instance, is made a tributary of the Wey, and the Kennet Basin is entirely wrong in nearly every detail. The map on p. 277, where the Wylye is miscalled the Nadder, is no better. These, however, are matters which can easily be set right in a new edition.

O. G. S. C.

COMMUNICATION WITH SPIRITS

The Survival of the Soul and its Evolution after Death. By PIERRE-ÉMILE CORNILLIER. (Kegan Paul, Trench, Trübner & Co., Ltd., 10s. 6d.)

When we are presented with a phenomenon such as communication with the dead, which is at variance with our common experience, we tend to adopt towards it an attitude of incredulity that has in it something of hostility because, it might be supposed, the new idea is a challenge to our faith in the "continuity of phenomena," and to accept it would mean for us a new adaptation to reality.

Such an attitude is probably instinctive, and would seem to serve a useful purpose in stabilising society, since it prevents the adoption of new ideas before their value has been conclusively proved, but it has the disadvantage of hampering criticism; the new ideas are defended with embittered and often indiscriminate zeal by their prophets, and what is true may be obscured by a multiplicity of fallacious "evidence." And to this particular question of communication from the dead some special unconscious resistance seems to be provoked, for primitive man every-

where looks upon his dead as at least potentially hostile, and the burial rites all the world over have a common object in placating the spirits of the departed or preventing their return. No wonder, then, that attempts to recall the dead have been proscribed as necromancy, or as spiritualism have been opposed with mingled uneasiness and derision, for something of the old primitive feeling still survives.

Much spiritualistic evidence has been exposed as fraud and much is pathetically slender, built up by the recorder to sustain a belief in the continued existence and happiness of some lost friend or relative. But M. Cornillier's work comes under neither of these headings; it would be an impertinence to suspect the good faith of the author, and his medium gained nothing from the *séances*, nor, for the most part, were the "spirits" who appeared known to anyone concerned.

The medium was a girl of eighteen, an artist's model by profession, and in a state of deep hypnosis induced by the author she appeared to see and speak with a number of spirits, chiefly with a venerable old man who dictated to her an account of the life after death, confirming the views held, we believe, by the theosophists; and, if we do not accept these views, at least they do not flagrantly outrage our sense of inherent possibility. In addition to exhibiting spiritualistic manifestations, the medium appeared to visit and to be able to describe towns and houses unknown to her and sometimes imperfectly known to the author. The spirits spoke of many subjects, including music and musical composition, with which the medium in her waking state appeared to be completely unacquainted, for her education was very limited and her tastes and outlook of the simplest.

If we do not uncritically accept an external, i.e. a spiritistic, agency for these results, with its momentous implications, we must seek to analyse them into terms of the already known, which is the normal, if (as some critics assert) the limited, method of scientific investigation. If we rule out conscious fraud and telepathy, which, even were it tenable, would prove in this case an inadequate explanation, there seems to remain only the question of whether we are dealing here with the expression of part of the unconscious self of the medium that has become dissociated from the rest of the personality. Without a detailed psychological examination of the medium such an hypothesis can only be very tentatively advanced, but we feel that we are perhaps justified in saying that the specific grounds upon which the author rejects it are not altogether adequate. He says that the medium "... is not a hysterical subject. She is . . . of clean constitution with no organic weakness." Yet it is not impossible that the dissociation of personality, if it existed, might have found its only obvious expression in the mediumistic state and the occasional hallucinations and trance-like conditions that seem to have occurred spontaneously, nor does the phenomenon of dissociation imply quite so deep a stigma of functional disease, still less of organic, as the author seems to suppose. Sir Thomas Browne wrote, "I am no way facetious, nor disposed for the mirth and galliardize of company; yet in one dream I can compose

a whole Comedy, behold the action, apprehend the jests, and laugh myself awake at the conceits thereof." Had he had such a collaborator as M. Cornillier, these remarkable comedies might have been secured for posterity, and without, we think, exposing their author to any very severe reproach of mental disease.

On the other hand there are indications—slight, it is true—of possible psychological abnormalities in the medium. The extreme readiness with which she passed into a state of deep hypnosis is a condition that is almost always found where there is a considerable dissociation of personality, and it is also to be noted that although she was eighteen she had "the air of a child of fifteen," and it is as a "child" that the author always refers to her.

It is interesting and perhaps significant that the chief spirit who appeared, the venerable old man, soon came to fill for the medium the rôle of an ideal father; he was protective and affectionate and he gave useful advice about the practical details of her daily life; she became very attached to him, and he seems almost to have replaced her real father, who was an alcoholic and a hopeless ne'er-do-well. The data given in the book are naturally not sufficient, nor of a nature, to provide a psychological explanation adequate to account for the very remarkable results recorded, but it is to be hoped that some day the spiritualistic phenomena may be thoroughly sifted and, when all results attributable to deception and unconscious expression have been excluded, we may perhaps look for some valuable addition to our knowledge in the residuum that remains.

F. A. H.

MISCELLANEOUS BOOKS

Mr. J. M. Keynes has written a sequel to his *Economic Consequences of the Peace*. His new work, *A Revision of the Treaty* (Macmillan & Co., Ltd., 7s. 6d.), advocates the following proposals for the economic settlement of Europe: "(1) Great Britain, and if possible America too, to cancel all the debts owing them from the governments of Europe, and to waive their claims to any share of German reparation; (2) Germany to pay 1,260 million gold marks (£63,000,000 gold) per annum for thirty years, and to hold available a lump sum of 1,000 million gold marks for assistance to Poland and Austria; (3) this annual payment to be assigned in the shares 1,080 million gold marks to France and 180 million to Belgium." Other books lately published and dealing with international problems are *The New World*, by Dr. Isaiah Bowman, Director of the American Geographical Society of New York (G. C. Harrap & Co., Ltd., 21s.), who has compiled a vast amount of information about the world's post-war political geography, and an admirably lucid and scholarly account of *Foreign Governments at Work*, by Mr. Herman Finer (Humphrey Milford, Oxford University Press, 2s. 6d.), in which a valuable chapter is devoted to Germany's new constitution.

The centenary of Pasteur's birth takes place in December of this year. We recommend those interested in the great scientist's work to read the new biography translated from the French of M. Descour, *Pasteur and His*

Work (T. Fisher Unwin, Ltd., 15s.). The impression which it, and indeed any biography of this pioneer, leaves upon the reader's mind is the orderly and progressive way in which every field of experiment which he entered led him on to another. After extensive studies of crystallography, Pasteur became a professor at Lille, "where the manufacture of alcohol from beetroot was one of the chief industries of the locality." The leading chemists of the day believed that the fermentation which produced this alcohol was entirely due to chemical action. Pasteur's work on crystallography made him sceptical of this belief, and in endeavouring to prove its error "he discovered the laws of fermentation and recognised the real nature of ferments." Thence he was led on to the discovery of anaerobes and to a "complete explanation of the dissolution of organic matter." Work followed on the origin of ferments, which was found of great help in meeting the epidemics that were then ruining sericulturists and which resulted in remarkable discoveries in human pathology. He "studied successively, or simultaneously, anthrax, the vibron-septique, the microbes of osteomyelitis and puerperal infection, chicken-cholera." It was work on the microbe of this last disease which promoted his most famous scientific triumph—vaccination.

Books of exploration and travel never cease to appear in great numbers. There is such little distinction about many of them that we welcome two, widely divergent in subject, that have lately appeared. The first is written by a well-known Alsatian theologist, musician, and doctor, Professor Albert Schweitzer, who gave up his professorship at Strasburg to do medical work in Equatorial Africa in the valley of the Ogowe River, which flows into the Gulf of Guinea. His account of his experiences amongst the natives and of the good and bad effects of Western civilisation upon them give one food for thought, and we intend reviewing his book, *On the Edge of the Primeval Forest* (A. & C. Black, Ltd., 6s.), at some length in an early subsequent issue. This remark also applies to Stefansson's *The Friendly Arctic* (Macmillan & Co., Ltd., 30s.). Stefansson led the Canadian Government's Arctic Expedition, 1913-18. Despite the daring of his adventures, he makes a striking case for the North as a "country to be used and lived in just like the rest of the world."

From time to time we receive astounding pamphlets on *Evolutionary Education* from the "Los Angeles Co-operative Information Center for Evolutionary Education." The latest pamphlet tells us of various new sciences, two of which are described as follows: "Embryogenetics is expressive of Mind, impulses and reason, and thus of the functional Principle. Ethereogenetics is expressive of Soul, emotions and intuition, and thus of the interacting Principle. It becomes necessary to advance such Super-sciences to the underlying neuro-motor, nervo-motor, muscular-motor and movement-motor *Combustion-processes* of different nature and importance. Internal Combustion is considered triune: *physical combustive, embryonal combustive and galvanic combustive*." And so on *ad lib.* Evidently Charles Chaplin is not the only humorist who lives in Los Angeles.

Books Received

(Mention in this column does not preclude a review.)

LANGUAGE AND LITERATURE

A History of Modern Colloquial English. By PROF. HENRY CECIL WYLD. Second Edition. (T. Fisher Unwin, Ltd., 25s.)

MISCELLANEOUS

The Yearbook of the Universities of the Empire, 1922. Edited by W. M. DAWSON, and published for the Universities Bureau of the British Empire. (G. Bell & Sons, Ltd., 7s. 6d.)

The Apple-Tree. By L. H. BAILEY. (The Open Country Books published by the Macmillan Company, New York, 7s.)

Materials for the Study of the Apostolic Gnosis. By T. S. LEA, D.D., and F. B. BOND, F.R.I.B.A. In two parts. (Oxford: Basil Blackwell, 6s. each part.)

The Evolution of Civilisation. By LORD CLIFFORD, F.G.S., etc. (The Evolution Society, 67 Madeley Road, Ealing, W.5, 5s.)

PSYCHOLOGY AND PSYCHICAL RESEARCH

Introductory Lectures on Psycho-Analysis. By PROF. SIGMUND FREUD, M.D., LL.D., Vienna. Trans. by Joan Riviere. With a Preface by Ernest Jones, M.D. (George Allen & Unwin, Ltd., 18s.)

Revelations of a Spirit Medium. By H. PRICE, F.R.M.S., and E. J. DINGWALL, M.A. (Kegan Paul, Trench, Trübner & Co., Ltd., 7s. 6d.)

A Unique Heathen, to which is now added Theodore Schroeder on the Erotogenesis of Religion. NANCY E. SANKEY-JONES. (Cos Cob, Conn, U.S.A.)

SCIENCE

Einstein and the Universe. By CHARLES NORDMANN. Trans. by Joseph McCabe. With Preface by the Rt. Hon. The Viscount Haldane, O.M. (T. Fisher Unwin, Ltd., 10s. 6d.)

A Criticism of Einstein and His Problem. By W. H. V. READE, M.A. (Oxford: Basil Blackwell, 4s. 6d.)

The Structure of the Atom. By STEPHEN MIAULL, B.Sc., LL.D. (Benn Brothers, Ltd., 1s. 6d.)

Calculus and Graphs. By PROF. L. M. PASSANO. (New York: The Macmillan Company, 9s.)

Protein Therapy and Non-Specific Resistance. By WILLIAM F. PETERSEN, M.D. With an Introduction by Prof. Joseph L. Miller, M.D. (New York: The Macmillan Company, 21s.)

Pasteur and His Work. By L. DESCOUR. Trans. by A. F. and C. H. Wedd, M.D. (T. Fisher Unwin, Ltd., 15s.)

Correspondence

THE INVENTION OF THE PILOT CABLE

To the Editor of DISCOVERY

SIR,

Mr. George Frederic Lees contributed to the March number of DISCOVERY an extremely interesting article on

Wireless Navigation and Nocturnal Flight, in which certain ingenious devices of M. Loth were described. In this article mention is made of "M. Loth's first invention, that of the cable guide for ships entering difficult harbours," and the writer proceeds to give "a short account of this electrical discovery which is already being exploited commercially." Now the Leader Cable, which is the recognised English name for what the French call the Cable Guide, was used by our own Admiralty during the war, while the system itself was invented and used experimentally as early as 1891 by Charles A. Stevenson, F.R.S.E., M.Inst.C.E., Ass.M.Inst.E.E. Mr. Lees is evidently wholly ignorant of Dr. Drysdale's Kelvin Lecture on "Modern Marine Problems in War and Peace," published in the *Journal of the Institute of Electrical Engineers* in July 1920, and of a later article in *Nature* of February 10, 1921, where the use of the Leader Cable is fully explained. In both of these articles Prof. R. S. Owen of McGill University is mentioned as having devised the same system in 1901 or 1903. My purpose, however, is to bring out clearly the fact that to Mr. Stevenson we owe, not only the first conception of the method and the first practical demonstration of its efficiency, but also the first published description of it. In 1891 he exhibited his apparatus in action to the Commissioners of the Northern Lighthouses, his express purpose being to lay an electric cable from a port to the open sea so as to pilot vessels into harbour. The method was described in a paper read before the Royal Society of Edinburgh on January 30, 1893, and published in that Society's *Proceedings*, vol. xx, 1892-95, p. 25. Meanwhile he had taken out a patent for the Pilot Cable, of which more hereafter. He continued working at the problem with practically no encouragement from others, and in *Nature* of December 31, 1896, he stated as an experimental result that signalling was effective at 200 yards distance from the cable. This was before the days of sensitive electrical detectors. In 1897 Mr. Stevenson constructed a working model representing his system in action on the French Coast in the neighbourhood of Ushant, and showing how a protecting cable could be used electrically to warn vessels (provided with suitable detectors) when they were approaching a dangerous shore. The model is still on exhibition in the Royal Scottish Museum, Edinburgh.

I propose now to reproduce the description given in Mr. Stevenson's patent of 1893 and compare it with the corresponding section in Vice-Admiral Fournier's Report on M. Loth's work to the French Academy of Sciences last year. The complete Specification of Mr. Stevenson's patent, which was accepted on March 4, 1893, is as follows:—

"A Means of Indicating Electrically the presence of a Coast, Rocks or Shoals, or determining a Ship's Position in a River, Estuary or Sea.

"Charles Alexander Stevenson, Civil Engineer, 84 George Street, Edinburgh, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

" My invention consists of an entirely new method of warning vessels electrically of their position or of their approach to a coast, shoal, mines or other danger. The apparatus consists of a submarine wire or wires, laid down in the bed of the sea, river, or estuary or out to any danger or anchorage or safe channel, through which intermittent currents are made to pass or the electrical state of which is made to alter by means of some form of electrical machine, generator or battery. These currents or changes of electrical state are detected by means of a detector of such currents or of the change of magnetic influence, or whatever it may be called, in the neighbourhood of the wire or wires through which such currents are made to flow, which detector may be on the ship or let down by rope or cable or coiled round the hull of the vessel. Whenever, therefore, a vessel comes into the neighbourhood or over the top of the wire those on board can detect its presence, and in consequence can locate their position. The currents have, if desired, different characteristics just as lighthouse apparatus has."

There then follows the description of a particular method which had been successfully tried.

In his report to the French Academy of Sciences (see *Comptes Rendus*, T. 175, 1921, p. 1231) Vice-Admiral Fournier, after a short introduction regarding M. Loth's inventions (*créations*), gives "the enumeration of his various inventions" under five headings, of which the fifth, literally translated, is as follows:—

" 5. Solution of the problem of the guidance of ships at their entrance into a port and at their exit in time of fog and in time of war, during the night with harbour lights extinguished, by means of a 'cable guide.' This cable stretched out on the bottom of the sea is traversed by an alternating current of musical frequency (600 or 1,000 periods per second). This current generates in the surrounding space a variable magnetic field of specified type. The form of this field varies with the frequency. Its lines of force cut through the surfaces of fixed coils (cadres) placed on board and beneath the ships and disposed, according to the special form of the field, in such a manner that every vessel, without other means of guidance may know at each instant: (1) the direction of the cable; (2) the inclination of its course to this direction; (3) its distance from the cable and the side on which it follows it."

The systems described in these two quotations are fundamentally the same. It can hardly be questioned that Vice-Admiral Fournier in his report to the Academy of Sciences credits M. Loth with the solution of a problem which had been solved by Mr. Stevenson in essentially the same way twenty-nine years ago.

The Council of the Royal Society of Edinburgh have already drawn the attention of the Academy of Sciences to the historical inaccuracy of the statement made in Vice-Admiral Fournier's report, an inaccuracy which is reproduced with greater definiteness in the article contributed by Mr. Lees, who even goes the length of using the French name "cable guide" for the recognised English name "Leader or Pilot Cable."

M. Loth undoubtedly deserves the highest praise for

the beautiful and sensitive devices which the modern development of electrical science has enabled him to make. Compared to these the early methods used by Mr. Stevenson cannot but appear primitive. But that in no way detracts from him the credit that is his due as the inventor of the "Pilot or Leader Cable." The Council of the Royal Society of Edinburgh regard it as a matter of simple justice that these facts should be known.

Yours, etc.,

C. G. KNOTT,

General Secretary,

Royal Society of Edinburgh.

April 20, 1922.

[Unfortunately this important letter from the Royal Society of Edinburgh arrived too late for us to send to Mr. G. F. Lees for his reply, which we hope to publish in our next issue.—ED.]

THE PROBLEM OF PERSONALITY

To the Editor of DISCOVERY

SIR,

You are to be congratulated upon the balanced attitude you assume in your editorial notes in the April issue of DISCOVERY. Your recognition that physiologist and psychologist are working from different angles is one that is worthy of every consideration, and there is no question that it is impossible for us to arrive at any solution of the problem of personality unless we regard the whole matter from every possible point of view and take all the facts into account. The trouble is that most of us are far too anxious to establish a theory and so are apt to recognise only such facts as support our theories, ignoring all others. The materialist is especially subject to this trouble and does not seem to think it possible that his facts are capable of any other than a materialistic interpretation.

Your strictures on Dr. Berman's book, *The Glands Regulating Personality*, are well merited by that author. The very assertiveness and "cocksureness" of this author are sufficient to discount his conclusions among men who realise the immensity of the problem and its many aspects. Personality is certainly more than a matter of glands, no matter how the latter may affect its operation. It seems to me that it is becoming increasingly impossible for us to conceive of personality in any other terms than those of mind, and to think of the body as any other than an ultimation of personality and the mechanism through which it is expressed. The crude materialism which gave rise to the statement that the brain secretes thought as the liver secretes bile, is now untenable in the light of psychological research.

With regard to the ductless glands, I wonder if modern workers have paid any attention to the remarkable work of Swedenborg dating from more than 150 years ago. I shall satisfy myself with pointing out that this patient student, by his wonderful deductions, anticipated many of the pre-eminent offices of the ductless glands, which the physiologist of to-day is just beginning to discover. This appears from a paper read by David Goyder, M.D., at the International Swedenborg Congress held in London

in 1910. Any reader desirous of studying the history of work on these glands should study this paper, which is printed in the published Transactions of the Congress and may be obtained from the Swedenborg Society, 1 Bloomsbury Street, W.C.1.

Yours, etc.,

CHARLES A. HALL.

WOODBURN, CLYNDER,
DUMBARTONSHIRE.
April 15, 1922.

To the Editor of DISCOVERY

SIR,

The value of Dr. Berman's book is its provocative character. In the case of the writer of the editorial comments in the April DISCOVERY it seems to have worked very well. The thesis of the book is at page 103 under "The Vegetative Apparatus." If the statements here made can be disproved by biologists, the fact can be stated in a few words.

I am informed that the demand for the book has outrun the supply. I suggest your contributor should try again and go one better. To belittle Dr. Berman's effort while refusing to consider genuine scientific work now being carried on in our midst does not make for enlightenment.

Yours, etc.,

(MRS.) ELIZABETH McLACHLAN.

147 HARLEY STREET,
LONDON, W.
April 17, 1922.

[It was obviously impossible to give an account of "genuine scientific work now being carried on in our midst" without occupying a great many more pages than we usually do for our Editorial Notes. In the space at our disposal we could not have done more than use the results of that scientific work to criticise Dr. Berman's book. In this number of DISCOVERY an account is given by a well-known research-worker in certain fields of the study, Dr. L. T. Hogben, of *Some Recent Work on the Ductless Glands*.—ED.]

To the Editor of DISCOVERY

SIR,

I am greatly interested in your proposal to set up a commission to collate the views of Science, Religion, and Intellect on the Problem of Human Personality. If the object is achieved satisfactorily it will not only meet a need urgently felt by most thoughtful people, but it will also, I think, achieve a definite advance in many branches of discovery.

All reasoned thought is an attempt to unify our otherwise disconnected experiences, and it can never be content till it has succeeded in unifying, or collating, every aspect of all our experiences. To my mind this characteristic of the human mind, the attempt to unify all experience, is no mere phase of human evolution, but is the reflection, or expression, of a fundamental reality. My acquaintance with the bulk of the knowledge embraced in these three terms is only of the general, or popular, kind for which DISCOVERY primarily caters; but the apparent differences between their conclusions seem to me to be almost entirely due to, first, the differences between their respective

terminologies, and, second, the failure of their votaries in general to recognise that their own terminology is necessarily in part merely metaphorical and in part merely arbitrary; that it is not, and in the nature of things cannot be, an exact and complete expression even of the particular conceptions which it is intended to represent, much less of the fundamental realities which these conceptions attempt to connote. They all, in fact, appear to me to be merely adventures of discovery into the same region, but using different languages, and setting out from different starting-points, or specially devoted to the investigation of different, but quite arbitrarily segregated, portions or qualities of the field of investigation.

Physical organisms have an independent career only to the extent that the life in them succeeds in co-operating with the physical world and so utilising it for the furtherance of its own self-expression. The more completely it succeeds in so co-operating, the higher becomes the form of life. Now, science appears to me to be the reflection, or expression, in our present highly artificial environment of the fundamental need of knowing ever more and more about the physical world in order to be able more and more effectively to co-operate with it for the satisfaction of the insatiable requirements of self-expression—requirements which seem to grow as it were in geometrical progression in proportion to the process of their realisation. Religion is the expression of the impulse to "get there" in self-expression, as distinct from the steps by which we try to get there; while the various mental activities summed up by you under the term *intellect* appear as the reflection of the fundamental need of judging of the degree of adaptability of our physical environment to the requirements of our self-expression, and of seeking perchance some other means of meeting these requirements, means maybe created by ourselves or by our fellow-men. But each of these is intrinsically mixed up with the other, is merely a different aspect of the same thing. The division into these three, or more, groups is itself only an arbitrary, and more or less borrowed, division, the only justification of which is the attempt to unify or simplify our experiences by classifying them; which is just the method of all reasoned knowledge. It is probable that none of the experiences dealt with by one of these groups can exist without the experiences dealt with by the others. For instance, it is probable that the desire to "get there" is only called into activity by contact with the means of getting there. Or it may well be, for instance, that relativity reigns at the very heart of things, that the difference between God's Creation and our own creation is merely one of degree, reflecting a similar difference between God and ourselves, or that the physical world is really merely the expression of that difference.

In any event it is clear that these various branches of discovery are so closely inter-related that each must throw a flood of light on the other; and I, for one, will await with eager interest the result of such an enquiry.

Yours, etc.,

J. R. HALDANE.

29 FRANCIS STREET,
STORNOWAY.
April 24, 1922.

otaries
ogy is
merely
things
of the
present,
the con-
appear
same
t from
the in-
gated,

only
erating
ther-
ely it
form
ction,
ment
more
e and
action
uire-
ctrical
ation.
here "
ch we
vities
as the
degree
uire-
nance
means
But
er, is
vision
rary,
ation
ences
of all
f the
exist
For
e" is
ns of
that
the
ation
rence
ld is

es of
row
wait